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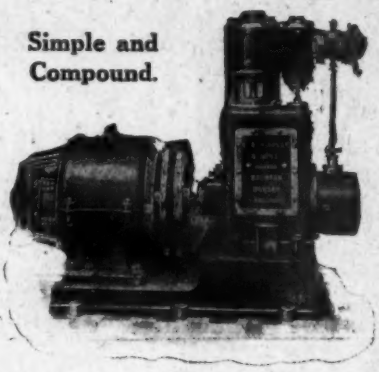

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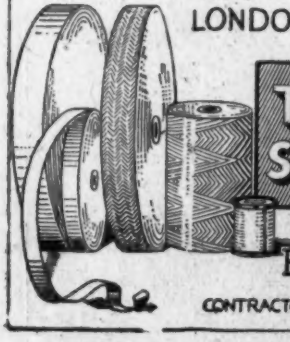

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ELECTRICAL REVIEW.

VOL. LXXXII. MARCH 22, 1918. No. 2,104.

ELECTRICAL REVIEW.

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THE IMPERIAL WIRELESS CHAIN.

SELDOM, if ever, we should think, has a Government contract of world-wide importance had such a chequered history as that of the famous Imperial wireless chain. Almost from the inception of this great scheme it was made the sport of party politicians; the first agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., which was signed on July 19th, 1912, providing for the erection of six stations to maintain communication between this country and our African and Asiatic possessions, was promptly challenged directly its terms were made public, and a Select Committee was appointed to inquire into the circumstances attending the negotiations. Rumours began to take shape regarding alleged financial transactions in which even Ministers of the Crown were involved, and the erection of the Imperial chain, declared a matter of national urgency by the Committee of Imperial Defence in December, 1910, was delayed for more than two and a half years by the machinations of the political wire-pullers.

Not one of those six stations, incessantly demanded by our military authorities as urgently needed for the defence of the Empire, was ever erected! Grim light is thrown on the subject by the facts revealed in the speech of Sir Edward Carson, in opening the case for the Marconi Co. in its action for damages against the Government last week-end. The war broke out before a single station was ready, and it is not surprising that the Government decided not to go on with the scheme; what is a matter for astonishment is that a great department of the Government attempted to shuffle out of the agreement, and that it continued to shilly-shally and to refuse to admit its liability to compensate the company for its heavy outlay and the loss of prospective revenue of which it was deprived by the decision to abandon the scheme. No wonder the Attorney-General and Solicitor-General were unable to persuade themselves that a position so utterly untenable could be seriously maintained in a court of law, and they acted rightly in "throwing up the sponge" before a single witness had been called.

As for the transactions that are alleged to have taken place between a Postmaster-General and another Member of Parliament and the German competitors of the company, seeing that the allegations have been strenuously denied, we must for the moment withhold comment; if they were proved to be true, or even well-founded, they would assume the very gravest importance, and could not fail to lead to results of the most painful character. It was, perhaps, unfortunate that the gentlemen concerned were not afforded an opportunity of meeting these charges in the witness-box. But we may say one thing—the point to which we are leading: throughout the whole course of events, from the first proposal of the Marconi Co. to erect a chain of long-distance stations to the present date, Mr. Marconi and his company have emerged from the mire through which the politicians have dragged his name, with an unblemished record; not a single item of the charges that have been brought against the company has ever been substantiated, and it has never been shown that the company has acted otherwise than in accordance with the dictates of commercial rectitude. We feel that the nation owes to the company, and in particular to Mr. Marconi,

a frank and ample apology for the unfair, un-British, and unscrupulous treatment accorded to them by Parliament and the Post Office.

National Electricity Supply.

Elsewhere in this issue we publish an abstract of an address by Mr. S. L. Pearce, which derives exceptional weight and importance from the fact that the speaker is the engineer and manager of the largest and most successful municipal electricity supply undertaking in the United Kingdom. The subject was the Interim Report on Electric Power Supply, and Mr. Pearce, while he agreed with the report in the main, handled very severely some of its principal features; we take it that his views may be accepted as those of the larger municipal undertakings of the country on this subject, and, as we anticipated in our issue of January 4th, he regards the report to some extent as an attack upon the principle of municipal ownership and control, which has become so firmly established in this country. He advocates the adoption of the principle of public control, at any rate for Lancashire, on similar lines to those which we indicated as likely to be acceptable to the municipalities—namely, by the formation of an authority that has no shareholders and pays no dividend, features of company management which, apparently, are anathema to the municipal mind.

Turning to the technical aspects of the matter, we again find that Mr. Pearce's views run on lines parallel to our own, expressed in our issue of January 11th. He points out that Tyneside, whose influence is so markedly reflected in the report, enjoys exceptional advantages of circumstance—yet possesses no "super-station"; that sites combining the *desiderata* of abundant supplies of coal and water are conspicuously rare in other parts of the country; and that the question of site resolves itself into the choice between lengthy transmission lines on the one hand and the use of cooling towers on the other, with the transport of coal as an additional consideration, all of which points were mentioned in our article.

The comparison given in the report between the relative costs of company and municipal supply is shown to be misleading, for the reason which we pointed out—namely, that the conditions obtaining in the areas concerned are not comparable. We also drew attention to the suggestion contained in the report that the average consumption of coal per H.P.-hour in factory installations was of the order of 5 lb., a figure which must be regarded as unduly inflated; while Mr. Pearce did not commit himself to an alternative estimate, he pointed out that the report was based upon this figure, and let it be plainly seen that he could not accept it as correct. We are pleased to find that our comments are in every respect confirmed by so eminent an authority.

Whitley Committees for Less Organised Trades.

The second Whitley Report has now made its appearance. It deals with industries in which organisation on the part of employers and employed is less completely established than in the industries covered in the first report, and with industries in which such organisation is weak or non-existent. Industries are classified according to the degree of organisation. Group "A" consists of those in which organisation is sufficiently developed to render the respective associations representative of the great majority of those engaged in the industry; these were the subject of recommendations contained in the first report, which has been made the basis of so much discussion recently. Group "C" comprises industries in which organisation is so imperfect that no associations can be said to be adequately representative. Between these two there is Group "B," which includes industries in which the degree or organisation, though considerable, is less marked than in Group "A." It is considered that in the main the proposals of the first report should be applied to the "B" group, *i.e.*, those found to be relatively well organised, but it is suggested that where in these industries a National Industrial Council is to be formed there should be appointed one or two official representatives to assist in the initiation of the Council, who should continue, after its establishment, to act in an advisory capacity and serve as a link with the Government. Such representative should be there merely in an advisory, and not in a voting, capacity, and experience should decide whether he should be retained, such retention being always subject to the wish of the Council itself. It may be that in some areas the establishment of District Councils for "B" industries can be effected to act in conjunction with the National Councils. In others, the National idea may not be immediately practical, but even here the District Councils might be formed, and it is anticipated that their formation would so influence the course of affairs that the industry would become suitable for National Councils to be formed also. Both Councils should, as in the case of "A" industries, be composed of representatives of the Employers' Associations and Trade Unions concerned, and the claims of women should be recognised. No fixed standard is laid down of organisation which should exist before Councils are formed. There is so great diversity of circumstances and such different degrees of sectional organisation, that the Committee favours leaving the matter to the decision of the Ministry of Labour and the organisations concerned. In regard to Group "C" it is thought that the machinery of the Trade Boards Act might be applied, pending the development of a larger degree of organisation, but such Boards should be empowered to perform larger functions than at present, enabling them to deal not only with minimum rates of wages, but with hours of labour and cognate questions, also to conduct inquiries on matters affecting the industries. It is to be left to the Minister of Labour to take appropriate measures for appointing such Boards where they are desired. Careful examination needs to be given to the question whether Works Committees can be applied in the case of Group "C," and the Ministry of Reconstruction has issued a separate report dealing with this point. Limitations of space prevent our entering into these matters in such detail as we should have desired under other circumstances, but we trust that our readers who, by reason of their connection with industrial concerns, are specially interested in proposals which are advanced to simplify and harmonise industrial relationships, will secure both the Second Whitley and the Works Committee reports. In short, it is thought that most of the principal industries of the country can be brought under one or other of the schemes now set forth. Broadly, they would be industries with Industrial Councils, and industries with Trade Boards, while further, in the case of the former class, it is possible that in certain sections or areas they might find it practicable to have Trade Boards associated with the Industrial Councils for determining wages and hours. It is recommended that State Departments and municipal authorities employing labour should now be interested in these matters as well as private industries. It will be observed that the whole policy is based upon *organisation*. It must also again be stated that the proposals are not advanced with any idea that there can be uniformity in practice in applying them. They must necessarily be adapted to meet the varyings needs and circumstances of different industries.

ELECTRICAL DEVELOPMENTS IN ITALY.

By E. STRACHAN MORGAN.

(*Concluded from page* 244.)

(2) When the application of water-power to electricity began to develop it was discovered that, save in exceptional circumstances, or when a business under favourable conditions produced electricity for providing power for its own purposes, it was only installations on a large scale, and with ample capital, that could work economically. The tendency has, therefore, been towards amalgamation and absorption, the number of companies being reduced and the field of their operations greatly enlarged. Take, for example, the Societa Ligure Toscana di Elettricita. This company was formed in 1905, with a capital of L1,000,000, for the service of the city of Leghorn. In 1907 its capital was L2,000,000, it provided 24,000 lamps and 3,500 H.P. In 1915, its capital had risen to L22,000,000; it provided 270,000 lamps and it produced 20,000 H.P., and had a plant in construction for another 10,000 H.P., and served the entire Provinces of Lucca and Livorno, and parts of the Provinces of Pisa, Massa, Firenze, Grosseto. Meanwhile it had absorbed the following companies:—Societa di Pisa, Societa Livornese, Societa di Lucca, Societa di Monte Catini, Societa di Monsumano, and several others. So again the chairman of the Societa Adriatica di Elettricita, in 1917, stated that, besides their share capital of L27,000,000 and debenture L5,000,000, the company had an overdraft of L11,500,000, and utilised it all; that the capital would be increased to L36,000,000; and that the Societa Italiana del Veneto, in which the Adriatica is largely interested, has increased its share capital from L14,000,000 to L15,750,000. The Verona Companies, in which the company is also interested; *i.e.*, the Societa Elettrica Milani, the Societa Veronese di Elettricita, the Societa Interprovinciale, have become more closely combined. The Adriatica has also contributed L100,000 towards founding the Societa Nazionale per Imprese Elettriche. It has large holdings in the Imprese Elettriche in Italia, and in the Societa Toscana per Imprese Elettriche. These are typical examples of what has occurred elsewhere.

The advantage of concentrating under a single management the supply of power to numerous manufacturers, and of controlling many sources of water-power, is very great. Besides the saving in office expenses and other general charges, there is the enormous advantage of the ability to equalise and average out the distribution of energy to many clients, some of whom may be slack in their work while others are in full blast; and it is of at least equal importance to be able to utilise the spare power of one set of turbines to supplement that of some other station where the water-power may be temporarily deficient. This centralisation, either by amalgamation of rival power companies or by close working alliances, is a movement that is quite certain to be still further developed in the future.

(3) The decrease in the price of KW.O.—There are here two aspects which must be distinguished. There is the actual cost of production, which inevitably tends to decrease with the increased potentiality of any establishment, and with the economy developed by the improvements in machinery, and still more as the proportion of the power at any time rented as compared to that produced increases. Then there is the price at which power is sold. Signor Omodeo (Il Problema Idraulico) states that companies have often sold under cost of production in order to induce customers to abandon the use of their steam. He states that from 3 to 4 cts. per KW.O. is a price made currently to large establishments, and that it has been sold even below 2 cts. per KW.O., which seems cheap, but we know that in Norway KW.O. is sold at less than ½ ct., and this is the price at which Italian companies should aim. Signor Conti, managing director of the Conti Electrical Co., writing in 1916 (Problema Idraulico, p. 20), says:—"During the past 15 years the mean of the index numbers of the chief necessaries of life has gone up about 50 per cent. On the other hand, the cost of electricity has been in continual diminution. The KW.O. for light, which in 1894 was sold in Milan for L1.40, is now sold at 50 cts., 40 cts., or even 20 cts. For power it could not then be sold for less than 25 cts., but is now currently sold to large consumers for 6 and 5 cts., and in some special cases for even less than 1 ct."

(4) The German invasion of the electrical industry in Italy marched to victory under two flags, one blazoned B.C.I., the other V.D.E. The work of the B.C.I. has already been referred to. The Banca Commerciale Italiana was concerned mainly with the finance of the enterprise, and managed to secure for its German patrons a controlling interest in a large number of Italian electrical power industries—the "key" industries of new Italy.

The V.D.E. worked on different, more insidious, but quite as useful lines. V.D.E. stands for Verband Deutscher Electrotechniker, the German association which formed a body of rules for the construction and use of electrical machinery, cables, &c., which were intended to form a basis for the purchase of machinery, and to safeguard the men who used it. In Italy, as in Germany, these rules have been accepted as binding in the industry, and in contracts for the building, the sale, or passing by the expert of any piece of machinery, a proviso is inserted that it shall be in accordance with the rules and formula of the V.D.E. Though it is hoped to substitute A.E.I. (Associatione Elettrica Italiana) for V.D.E., this has not yet been done, and the German formulæ still hold the field, or, at least, did so till after the declaration of war.

It is very exceptional in Italy to find any reference in contracts to the formulæ of the American, English, or Swiss Associations. The prestige attaching to the machinery made in the country which had originated these rules and monogram counted for much, but the powerful firms, Siemens-Schuckert and A.E.G., did not fail to make use of the influence they had over the men of science. "When I have carried out a scheme of conquest," said Frederic the Great, "I shall always find a pedant who will provide a justification." So these big firms, when they found it necessary to sell their surplus product abroad, used the "pedants" of the V.D.E. to facilitate the invasion of Italy by modifying their formulæ to suit the object in view, which was the sale of lighter and cheaper stuff at the higher price, a bit of statecraft which could be justified by a manipulation of these formulæ. The advantage of selling the lighter machinery was twofold: it cost less to build, and, inasmuch as the Italian duty is collected according to weight, and not *ad valorem*, it paid a smaller duty. "One of the points with regard to which there was much uncertainty," writes Signor Semenza, "was the definition of the power of any electrical machine: what was really meant by a dynamo of 100 KW. or a motor of 100 H.P.? The skilful modification of a few carefully-selected formulæ was sufficient to enable a machine, which had previously been classed as of 100 KW., to be labelled 120 KW."

Thus it came about that, backed by the prestige which attached to all products of German "kultur," and by the help of B.C.I. and V.D.E., the German manufacturers were able to sweep the Italian market, and not only to sell their own produce to meet the increasing demand for electrical machinery, but also to starve out native firms, with the result that

of the 18 firms which exhibited at Como in 1899, very few now survive.

It is impossible from the statistics of the Italian Custom House to discover what is the German importation of electrical machinery, as much of it comes in as "partly manufactured goods," in order to be entered at a lower scale of duty, and the classification of the Custom House does not always distinguish between electrical and other machinery. Allowance must be made for this in estimating the apparent decrease of importation of electrical machinery from Germany into Italy. It seems possible, though there is no proof of this, that the Germans took more advantage of the regulations enabling them to introduce their unfinished machines as "ironwork." Moreover, the diminution in weight of the individual machines referred to in what has been written about the V.D.E. must be allowed for in estimating the number of machines as compared to the total weight imported.

The *Elettricita* of Milan, March, 1910, referring to the returns of imports and exports for 1909, states that "During the year 1909 there were imported, of machines exceeding one ton in weight, 43,000 quintals; during the year 1908, 53,000 quintals. The decrease was in German machines, which dropped from 36,000 quintals, while Switzerland gained 2,000 quintals, importing altogether 8,000 quintals.

"Of machines under one ton, Italy bought 30,000 quintals in 1908, against 24,000 quintals in 1909. Of these, 23,000 quintals in 1908, and 17,000 quintals in 1909 came from Germany. The quantity of new electrical machinery installed in Italy each year is probably stationary, but Germany has lost to the advantage of Italian manufacturers and those of other countries, especially Switzerland."

It would seem that, though the Central Powers are predominant, their monopoly is not so complete as it was. But against this it must be observed that some at least of the Swiss manufacturers are closely linked up with the German banking groups, the A.E.G., Brown, Boveri, &c.; and that several of the Italian firms are merely German emanations which do their work in Italy to avoid Customs regulations, while their control comes from, and their profits go to, Germany.

Steel Transmissions in the States.—The Pacific Coast companies are giving considerable attention to the use of steel in place of copper for transmission lines. Steel conductors not only effect a saving due to reduced cost per unit of length, but also because of the longer spans permissible.

Standard spans of 350 ft., with No. 6 or No. 4 solid. and 450 ft. with No. 2 or No. 1 stranded copper, have been used extensively in the past; with the introduction of steel a 700-ft. span was selected as standard, and many miles of line have been built with spans of this length. The spans necessitate large sags, and the old style triangular construction, with pole-top pin, has been adopted, to give greater clearances between conductors.

Owing to the greater strains, more careful guying is required at corners, and at sharp corners four or six anchors to the pole are occasionally required. The San Diego Co. has now installed in main or branch lines, exceeding a mile in length, 201 wire miles of ¼ in., $\frac{5}{16}$ in. or ⅜ in. standard steel; 75 wire miles are under construction, and there are 52 wire miles of ½-in. steel in constant-current series circuits.

Most of the constant-pressure circuits are at 11,000 volts, though a few are at 2,300 volts.

A recent issue (Vol. LXXI, No. 2) of the *Electrical World* contains a summary of the specification used in a recent 11-mile extension. The conductor was of ⅜-in. extra-galvanised seven-strand standard steel. The normal 700-ft. span to vary according to the country; maximum single-pole spans to be 1,000 ft.; spans exceeding 1,000 ft. to terminate on double-pole structures; high-strength steel to be used for spans exceeding 1,500 ft.; 200-ft. spans, where possible, in crossing railways, highways and telephone lines. Clearances:—Railway, 28 ft.; high-roads, 24 ft.; other supply or communication lines, 6 ft. Standard pole length:—Tangents, 40 ft.; corners, 45 ft. Poles set in concrete in heavy marshes:—Trussed poles set in concrete or push-brace where anchors cannot be placed. Triangular wire arrangement with six-mile barrel transpositions, unless by special agreement.

NOMENCLATURE.

Continuous Current *versus* Direct Current, and Voltage *versus* Pressure.

By A. P. TROTTER.

In 1909 the Nomenclature Committee was appointed by the British National Committee of the International Electrotechnical Commission, to consider and to draft definitions of the electrotechnical terms in use in the English Language. The Committee consisted of Dr. S. P. Thompson, W. Duddell, Dr. A. Russell, R. Hammond, H. W. Miller, F. H. Nalder, C. H. Wordingham, R. W. Hammond, A. Siemens, C. le Maistre (secretary), and myself (chairman). The bulk of the work was done by the first four or five members named.

The object of the Committee was to record the usage of terms, to decide which of two or more terms of identical, or nearly identical, connotation had the best claim for recognition, to draft definitions as concisely as possible, and, having regard to the International character of the work, to avoid idioms, and to promote concord with foreign terms and their definitions. New terms are sometimes invented to express new ideas. It was not the business of the Committee to look for new ideas. They found that there were considerably more terms than ideas, and that the use of some of the former might be discouraged.

A list of terms from A to E was issued during 1910, and Committees in Denmark, France, Germany, Italy, and Mexico were soon at work. In 1914, the British Committee having revised their first section, completed their list, and it is interesting to note that they were so impressed by the lucidity of the drafting of some eight or nine of the Danish definitions, that they adopted translations of these. Alphabetical arrangement was not philosophical enough for the Germans, and they delayed the work considerably, for the British Committee turned aside to examine their proposals, which included such terms as *Leistungsschild*, a Name-plate. Something might be said about settling the legend to be put on the name-plate, but that was work for another Committee. The next word on their list was *Lieferungsbedingungen*, and when this barbarous noise is translated, it falls to pieces into Conditions of Delivery (tender). The Committee did not think they were called upon to define what these conditions should be, and what the Germans proposed to do with it was not clear.

In an introduction to the British list which was published in the *Journal* of the Institution of Electrical Engineers, Vol. LII, No. 233, and which is reprinted, and may be obtained separately, they asked that the list which they presented should not be taken as final, as they were aware that there was considerable difference of opinion on the exact meaning and interpretation of some of the words, and they hoped that suggestions would be sent through the Secretary of the Institution of Electrical Engineers which might eliminate errors and set up standard definitions to be finally accepted in this country.

Some of the terms considered are used only in electrical science, others only in engineering, and not a few were found which the Committee decided to discourage, *e.g.*, Alternation, for Half a Period; Magnetic Resistance, for Magnetic Reluctance; Effective Ampere and Volt, for Virtual Ampere and Volt. Some terms, such as Nominal Horse Power, Voltaic Cell, and Tension (when used alone) were declared to be obsolete. The Committee anticipated that material divergence between British and American usage existed, but very few cases were found, and most of these were unimportant, *e.g.*, the Carcase of a dynamo, alternator, or motor is called the Body in U.S.; a Choking Coil is a Reactance Coil or Kicking Coil; a Period is a Cycle; Earth is Ground; a Feeder Box is a Junction Box. One term alone demanded careful attention, namely, Continuous Current, which is commonly called Direct Current in U.S.

Neither Faraday nor Maxwell used the expressions Continuous Current and Alternating Current. Many of the terms of physics are derived from the French. In the seventies of the last century the best text-books of general

physics were Deschanel and Ganot, translated, and Jamin's Cours de Physique. *Courant continu* was, and always is, used in French, *corrente continua* in Italian. Curiously enough, *corriente continua* appears in the Mexican definition of the overload of a generator, and is immediately followed by *corriente directa* in the overload of a motor. The Danish *Jævenstroms* does not help us much.

The expression Continuous Current was invariably used both by scientific men and by engineers in this country until the term Direct Current was introduced from the United States. In the great controversy between advocates of continuous current and of alternating current 25 years ago, before the advent of the three-phase motor, Direct Current was never mentioned. An hour or two spent among the back numbers of technical journals might reveal the date when it first appeared. (I once found the date, almost the page where the decimal comma was introduced into French literature, instead of the older decimal point which we use.) In 1895 Ward Leonard wrote of continuous current, and Mr. Hobart has used it habitually, and his book on Continuous-Current Dynamo Design is well known.

There can be no doubt that the reason for the growing use of Direct Current in this country is the concomitant use of the contraction D.C. Many men refuse to employ the contractions E.M.F. or P.D., of which Prof. Ayrton was fond, but they have the words Pressure, Voltage, or "the volts" readily to hand. Perhaps life is not long enough for Continuous Current and Alternating Current. There is a class of engineer who talks of C.B., meaning Circuit Breaker, and E.H.T. for Extra-High-Tension, and of S.P. and D.P. switches. Even mathematicians write R.M.S. for root mean square, and K.V.A. for kilo-volt-ampere. The contraction C.C. is very seldom used for Continuous Current. There would be no confusion with c.c. meaning cubic centimetres. There is no reason that D.C. should not be employed, seeing that we use P.M. meaning afternoon and lb. and oz. for pounds and ounces.

This matter was carefully discussed in Committee, as I well remember, when Dr. S. P. Thompson and Mr. Duddell were present, and we agreed that the standard British usage was Continuous Current. We defined it as an electric current in one direction, and sensibly steady or free from pulsation. We suggested the abbreviation C.C., and, in so doing, we no doubt exceeded our general principle of recording the usage of the day. We added "the term Direct Current is not recommended. (The term Direct Current is much used in U.S.)"

Before arriving at this decision we corresponded about this and other terms with representative men in the United States. I, at all events, was rather surprised to learn that they were by no means unanimous about Direct Current, and that some of them would be glad if Continuous Current were adopted. I am writing of the year 1909, and I admit that Direct Current has become much more common here during the last nine years.

The Committee took into consideration, for what it was worth, the official use of Continuous Current in Board of Trade Regulations. It is safe to say that when these were first drafted the expression Direct Current was almost unknown over here. But Major Cardew had definite views about it, and I have no doubt that he consulted Sir Courtenay Boyle, an excellent scholar, who delighted in philology and accurate use of language, who took so keen an interest in electrical engineering, and was always ready to help. Major Cardew had to classify systems, and to recommend them for the approval of the Board of Trade. Until 1906 a separate description was drafted and approved for each undertaking. An electrical supply through a simple circuit from the dynamo to the lamp appealed to him as a direct supply, while in the case of alternating current the house transformer (for in those days each house was so provided) interrupted the circuit, and the lamp connected to the secondary was said to receive an indirect supply. These terms, direct and indirect, were always used for official purposes of description of systems, *e.g.*, "A continuous current direct supply at low pressure," and it is not surprising that he adhered to the common use of the term Continuous Current, notwithstanding the fact that the Brush and the Thomson-Houston machines of those days gave currents by no means "steady or free from pulsation."

I do not write this to justify and uphold the decision of the Committee, but merely to state some of the grounds on which it was based. The merits of the terms themselves are of minor importance, and I will not discuss them. Personally, I have no strong views on this subject. As one of the old school, I generally speak of continuous current, and I do not naturally talk in capital letters, but if some one speaks to me of D.C. and A.C. I would, to be polite, or to humour him, do the same. I have said that the Committee invited criticism, stating that their list of March, 1914, "must not be taken as final." Although I had some interesting correspondence about the A to E list in 1912-13, I am not aware that any suggestions have been made until a few weeks ago, when the use of Continuous Current was challenged. I understand that the B.E.A.M.A. have circularised their members, and have a big majority in favour of Direct Current. I am not surprised at that. This is still a free country, and anybody may use what terms he likes. Agreement only becomes desirable when Reports or Rules are drawn up by a body like the Engineering Standards Committee. The term Continuous Current was used in the Standardisation Rules which were agreed to by the B.E.A.M.A. two years ago, and the proposal for a change to Direct Current was only once alluded to in the course of the Anglo-American Conference held at the end of last year; so that I am surprised to learn that there is something in the nature of a demand for an immediate change, and "a decision to be reached fairly soon." Possibly the time has come for the change, but there is no reason for rushing it through. The chief reason for retaining the old term Continuous Current is agreement with the French, Italian, and Spanish usage.

Another matter is being raised—a very old one, which never has been settled, and which I do not think needs settling. Electrical science has a collection or choice of terms connoting that which we measure with a voltmeter, namely, Difference of Potential, D.P.; Electromotive Force, E.M.F.; Pressure, Volts, and, when qualified by High or Low, the obsolete term Tension. I do not remember seeing a clear distinction made between difference of potential and electromotive force in any of the older text-books. I venture to think that even a few modern students would be puzzled to explain in terms of difference of potential what happens when a series of, say, ten cells, each giving one volt and having an internal resistance of one ohm, is short-circuited.

When the original Board of Trade Regulations were drawn up the expression Voltage had hardly appeared, and, if used, was probably regarded as slang. Major Cardew knew the difference between difference of potential and electromotive force. He needed a term for the latter, and, like many scientific men (Maxwell excepted*), the expression electromotive force did not appeal to him. Even if in the modern sense it can be called electromotive, and if from Maxwell's point of view it can properly be called force, the term is a mouthful, and savours of pedantry; so the word Pressure was officially adopted. Of course, there were and are obvious objections to it, but few of us seriously worry about them. The use of the term Voltage has of late largely extended, but more among engineers than among scientific writers. Originally it was used in a descriptive sense, as in speaking of the voltage of a certain lamp, as we speak of the acreage of a field, the mileage of a railway, or the tonnage of a ship. "The Volts" is an expression often used, and Pressure, Voltage, and "the Volts" are not quite synonymous. The official use of the expression Pressure need not count for much. Any old moth-eaten term is good enough for our present electrical legislation. Who dreams of talking about "the electrical quantity contained in a supply," or would tolerate the fatuous legal definition of an Electric Line or of a Street in the Act of 1882?

I tried to induce Dr. Silvanus Thompson to write a paper on the work of the Nomenclature Committee, to explain its aims and methods, to describe its difficulties, to give reasons for its choices and definitions, while these were fresh in his mind, and to invite criticisms and help. Some of the thousands of electrical engineers who have never heard that

* "Electricity and Magnetism," Vol. II, page 196.

such a Committee existed, and who have never seen a copy of their work, might have been interested.

As soon as I was appointed to serve on the Committee I put together a list of about 150 terms and definitions, as something to start upon. On turning over this list I find a few which were left over.

Assistant.—The man who does the work and takes the blame, if any.

Board of Trade.—Usual abbreviation for the Right Honourable the Lords of the Committee of His Majesty's Privy Council appointed for the Consideration of Matters relating to Trade and Foreign Plantations.

Boss.—The man who takes the credit and the profit, if any.

Committee.—An apparatus for concentrating duties on the shoulders of one or two men, who work between the meetings, and distributing the credit for it among those who talk most at the meetings.

THE WORK OF THE ELECTRIC VEHICLE COMMITTEE.

Although it is some little time since a report was issued dealing with the work of the Committee, it must not be inferred therefrom that the latter has ceased its activities. The Committee's efforts have been mainly directed to negotiations with Government Departments with a view to facilitating the extended use of commercial electric vehicles by an increase in home construction, and a modification of import restrictions. It may be mentioned that the maintenance of all electric vehicles in service for utility and national work is strongly supported by H.M. Petroleum Executive on grounds of petrol economy.

The Committee has been in close consultation with the Ministry of Munitions as to fuel economy and upon the question of the allocation of lead for lead-plate batteries. The Committee has obtained a promise from the Munitions Overseas Transport Department to allot shipping space up to a total of six tons per week for the importation from the United States of lead battery plates for electric vehicles. It has been decided to let the battery and vehicle makers apply, with the support of the Committee, within the approved weekly limit of weight, to the respective Government Departments concerned in import and shipping questions in respect of any batteries that may be required.

In July the Committee was requested by the Mechanical Transport Department of the Ministry of Munitions to co-operate in a scheme, proposed by the Director of Mechanical Transport, for getting more electric vehicles put into service with a view to saving petrol, and a concomitant to this scheme was a proposal to provide facilities for the building of electric vehicles in quantities by certain British firms, and the importation of vehicles from the U.S.A. Owing, it is understood, to the increasing stringency of the steel position for war purposes, the contemplated scheme did not admit of adoption.

In some quarters there have been signs of opposition on the part of the motor traders to electric supply authorities taking up the care and charging of electric vehicles, but this has proved to be due to a misunderstanding of the position, which, now that the motor manufacturers and motor traders are represented on the Committee, it is hoped to remove, with resulting harmonious co-operation between all interests. To this end a joint meeting is being arranged of the Council of the Motor Trade Association and the Electric Vehicle Committee.

The Committee's aim has been to make its constitution as completely representative as possible of all interests concerned, and, in accordance therewith, the following members have been added:—

Mr. Goodwin (managing director of C. A. Vandervell and Co., Ltd.), as representative of the Motor Trade Association.

Mr. H. Wyatt, as representing the British Motor & Allied Manufacturers' Association.

Mr. J. P. Kemp, as representative of Agents for Electric Vehicles.

Mr. P. Still, who has been a member of the Committee from its early days, as representative of the Chelsea Electricity Supply Co., now becomes, by the consent of nine out of 13 companies, the representative of London Electricity Supply Companies on the Committee.

New Aluminium Works.—In Norway a new aluminium company has been formed under the style of Nordisk-Aluminium-Industri, with a capital of 1,000,000 kroner; the works, which in every respect are to be fully up-to-date, are to be located at Hinna, and several hundred workmen will be employed.—*Engineering.*

THE FARADAY SOCIETY.

General Discussion on "Electric Furnaces."

The latest general discussion held by the Faraday Society was on "Electric Furnaces," and it took place at the Municipal Technical School, Manchester, on February 14th. Prof. C. A. Edwards, of the University, presided over a large gathering.

The papers and discussion covered a very wide range of subjects, from types of furnaces for attaining high temperatures in the laboratory to the broad principles of furnace design dealt with by Mr. J. Bibby, and including, by the way, such matters as electrodes, transformers, wave forms of impressed voltage, and refractory linings. Special interest, however, attached to the more purely electrical problems that arise in connection with the design and use of these furnaces, and it will be appropriate if we confine this report principally to this aspect of the subject.

By way of introduction it may be said that in spite of the absence of water-power, the number of electric furnaces used in England since the war for manufacturing steel has increased some forty-fold. Mr. Donald F. Campbell emphasised the importance of this progress, which indicates that large deposits of lower grade, more especially phosphoric, ores, until now neglected by the smelter, will be able to be utilised for steel making, and there is no reason why Great Britain should not become, if it is not so already, entirely self-supporting as regards the special steels and ferro-alloys now so essential to the engineer.

It is improbable that the general types of furnaces now in use will materially change. Those chiefly in use in this country are the Héroult, Greaves-Etchells, and the Electro-Metals patterns. The Héroult has three upper electrodes connected to a star or delta group of transformers with the molten bath as an unconnected star point. In the Greaves-Etchells the hearth, made specially thick for the purpose, is connected as one leg of a star connection. The Electro-Metals furnace connects each group of upper electrodes to one of two phases, and connects the hearth and molten bath as a common neutral. These types are all arc-resistance furnaces. The single-phase Synder furnace, for which is claimed an exceptionally low electrode consumption, is also in use. A plea was put in by Mr. H. Etchells, who generally surveyed the subject, for the greater development of the pure resistance type, which was ideal from the electric load standpoint, on account of its high load power factor and slight fluctuation. The Bailey furnace, in which the resister material consists of broken electrode carbon, granulated coke, and suchlike materials disposed in an open trough encircling the interior hearth, was a furnace of this type coming into considerable use in the United States for re-heating and annealing purposes. As far as this country is concerned, it did not appear from the discussion that any great development in the use of induction furnaces was to be expected. Apart from their low power factor—which calls for very cheap hydro-electric power—their principal use is for melting exceptionally pure scrap, such as is not here generally available. On the other hand, their value for melting the non-ferrous metals does not seem to have been sufficiently considered.

It is interesting to note that the capacity of the largest units of steel-melting furnaces now made—only some 30 tons, even in exceptional cases—is not considered likely to be exceeded in the future, as the limiting efficiency seems almost to have been attained, unless some very radical alteration in design is made. The question of electrodes, always a troublesome one, begins to present serious difficulties with the big furnaces carrying, say, 20,000 amperes, for half this current is as much as any electrode will at present carry. The problem is solved by having multiple electrodes, but the application of the usual three-phase current to, say, a furnace with four electrodes presents obvious electrical difficulties. Mr. Bibby has very ingeniously got over these difficulties.

Whatever system is adopted, it must be such that when equal currents are flowing through each of the arcs, then equal currents must be taken from each of the three high-tension mains, and each of these three primary currents must be practically in phase with its voltage in order to secure a high power factor. Further, to ensure circulation of the molten metal, it is desirable that a certain amount of current should flow vertically through the hearth to a fifth fixed electrode beneath it. Some system is therefore required which will impress an equal voltage between each upper electrode and the hearth electrode, so that when equally adjusted equal currents, and therefore four equal heating zones, will be obtained.

The condition is met if we can obtain on the furnace side of the transformers four equal phases, one for each electrode, and a common return to a neutral electrode beneath the hearth. In short, we require a 4-phase, 5-wire system. This can be obtained by simply having two sets of two phases working in parallel, but this system has serious electrical objections, and the problem has been solved in another way by the Electro-Metals 4-phase arrangement, which consists of three single-phase transformers. Two of these transformers have their terminals connected separately to the four upper electrodes. A tapping is taken from the middle of the third or Teaser transformer to the hearth electrode, and the

terminals of the Teaser transformer are connected to intermediate tappings on the main transformers. A closed system is thus obtained when arcs are struck between the four upper electrodes and the bath of metal. This system gives an equal voltage in each of the arcs, and therefore equal heating zones, and also when the electrodes are regulated for equal currents, then equal currents are taken from the three primary mains. The average power factor of the system on a non-inductive load is unity. Further advantages of the system are that when the furnace is under poor regulation the primary currents remain tolerably balanced with a high power factor.

The important matter of methods of controlling electric furnaces was dealt with by Messrs. A. P. M. Fleming and F. E. Hill, who classified in a systematic manner the various methods in use. In practically all furnaces a certain amount of auxiliary control is obtained by raising or lowering the electrodes, either by hand or automatically. But the wider range of control that is usually necessary can only be obtained by varying the applied voltage on the furnace terminals. The following five methods of doing so were described and illustrated:—

1. Alteration of the ratio of the main transformer by cutting out a portion of the primary winding.
2. Alteration of the ratio of the main transformer by an auxiliary winding which can be connected up in series with or in opposition to the main winding.
3. Use of a primary booster transformer to vary the secondary voltage by altering the pressure supplied to the primary.
4. Use of a secondary booster transformer, the secondary of which is in series with the main secondary, the booster primary being in parallel with the main primary.
5. Control by means of a motor-generator; a method rarely used.

Several speakers, following Mr. Bibby, discussed in an interesting manner the general principles underlying electric furnace design and operation. Mr. R. G. M. Mercer, coming to study the subject with no preconceived ideas, gave it as his impression that electric furnaces were operated too much as if they were Siemens open-hearth furnaces. In particular, he criticised the wide doors, usually open at the bottom, and the large electrode spaces at the top, both of which tended to reduce efficiency and increase electrode consumption. As to the latter point, certain economisers were now in use which effected a 20 to 30 per cent. saving of electrodes. Prof. W. G. Fearnsides considered that on the mechanical side we had only arrived at the A B C of furnace design. His strictures referred more particularly to the mechanical strain on refractory linings and electrodes in the usual pattern of tilting furnace.

A general impression one gathered from the discussion was the limitation placed on the possibilities of electric furnace development by the want of a really first-class refractory material, particularly for the roof of the furnace. The genius of the electric furnace lay in its power of concentrating an enormous amount of heat in one confined area—precisely where the metallurgist wanted it, and it was the refractory that limited electric heating being used to the greatest advantage. Silica bricks as used at present for roof-vaults were good up to a point, but they were limited not only by temperature, but by corrosive action in the case of basic ores.

Refractories—perhaps magnesite or zirconia—fused electrically at temperatures much above that they would have to stand in position probably offered the best way of meeting these difficulties, but at present the question of cost barred the way of progress. The need for extended investigation in this direction is paramount.

LEGAL.

Marconi Imperial Wireless Chain Litigation.

In the King's Bench Division on Thursday, March 14th, the agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., Ltd., for the construction of a chain of wireless stations came before Mr. Justice McCardie in the form of a petition by the company for a declaration that the Postmaster-General was not entitled to repudiate the agreement, and for damages.

Counsel for the company were Sir Edward Carson, K.C., M.P., Mr. Leslie Scott, K.C., M.P., Mr. Geo. Wallace, K.C., and Mr. Stuart Beavan, and for the Postmaster-General counsel were the Attorney-General (Sir F. E. Smith, K.C.), the Solicitor-General (Sir Gordon Hewart), Mr. A. C. Walter, K.C., Mr. G. Branson, and Mr. Harold Smith.

Sir Edward Carson, for the Marconi Co., said that they had filed a petition making a claim for a declaration that the Postmaster-General was not entitled to repudiate an agreement of July 30th, 1913, and that the said agreement was wrongfully repudiated by him, and then a declaration that the suppliants should be entitled to damages and to such other relief as might be necessary. Under that agreement the suppliants contracted to provide and construct six long-distance stations in England, Egypt, the East African Protectorate, the Union of South Africa, India, and Singapore. As regarded the first three of these stations—England, Egypt, and East Africa—the contract was to be an absolute contract, but as regarded the second three stations—the Union of South Africa, India, and Singapore—there was in the contract a right to the Postmaster-General, by giving notice at any time up to the completion, to cancel that operation of the contract, and to pay out-of-pocket expenses without other compensation. The agreement was duly confirmed by a resolution of the House of Commons passed on August 8th, 1913, and as regarded the installations in the Union of South Africa, Egypt, and India by the Governments of those places, and by the Secretary of State for India in Council. No notice was at any time given by the Postmaster-General of his cancellation of such part of the agreement as related to the establishment and installation of the stations in the Union of South Africa, India, or Singapore. On the contrary, the company said that in the case of the Indian station, the Postmaster-General decided, on or about May, 1914, that such station should be proceeded with in the first instance, and so informed the suppliants, who agreed to proceed with the same. The company had at all times been ready and willing to proceed to carry out the installations between August, 1913, and December, 1914. On December 31st, 1914, a letter from the Secretary to the Post Office repudiated the agreement, and refused to allow the company to proceed further with the installations. On August 21st the Postmaster-General paid a sum of £62,000 on account of expenditure incurred. The company said that they had been greatly damaged by being deprived of all the royalties which they would have earned under the agreement, and that they had lost the whole of the moneys expended. If the Post Office had repudiated the contract the company would be entitled to damages, for they had never refused, in fact they were always pressing, to go on with the contract, and to get the necessary information and direction to go on. On January 11th, 1915, the company wrote claiming compensation for the alleged abandonment of the agreement by the Postmaster-General, and the latter thereupon by letter of January 21st, 1915, withdrew his letter of December 30th, 1914, and offered to co-operate with the company in carrying out the terms of the existing agreement with all possible promptitude.

With regard to this letter, Sir Edward said his contention would be that, upon the facts of this case, that was an unreasonable offer under the circumstances, and one which they were not bound to accept, and one, indeed, which it would have been impossible to accept. He maintained that his clients acted with reason in refusing to have anything further to do with the contract after the letter of December 30th. Having related the history of matters up to the approval of the contract by the House of Commons, Sir Edward said that if ever there was a contract over which care was taken that the Post Office should not incur the displeasure of the House of Commons or anybody else, it was this contract, and the extraordinary thing was that, after all the precautions taken and all the urgency, none of these stations had up to the present time been erected. The company had since 1912 been treated as regarded their contract in a manner in which, he submitted, no commercial firms would treat each other. It was now six years since the first of these contracts was entered into, and the company was now solemnly told, after all the expense that it had been put to, that it had no claim for damages.

Sir Edward then proceeded to read the correspondence, which was voluminous, and, in course of the reading, remarked that the company was astonished one morning to find an advertisement in most of the newspapers inviting applications to tender for the construction of the second three high-power wireless stations of the Imperial chain from any wireless company, syndicate, or contractors who were able, by means of practical demonstration, to satisfy the Postmaster-General of the efficiency of their system.

That was done, Sir Edward proceeded, without a word to the company, who considered the action of the Postmaster-General almost incredible. The chairman of the company (Mr. Isaacs) wrote pointing out that a more damaging statement to the company it would be impossible to imagine, having regard to what had taken place in the House of Commons and the country. There was, said Sir Edward, something at the back of the action of the Government all through in relation to this. Mr. Samuel, in reply to that letter, assured Mr. Isaacs that the announcement in the newspapers was merely to satisfy demands made in the House of Commons, that no replies had been received, and that they were all aware that no such demonstrations as were asked for could be given, and that a statement should be inserted in the Press to remove the impression created by the announcement, and he hoped to give instructions shortly to proceed with the erection of all six stations, subject to ratification by South Africa.

On Friday Sir Edward Carson continued the reading of the correspondence. He said that in June, 1914, Mr. Isaacs, in Paris, learnt to his astonishment that the Postmaster-General (Sir Charles Hobhouse) and Sir Henry Norman, M.P., had been to Berlin, and tried to induce the Telefunken Co. to compete in England with the Marconi Co. in connection with the contract: Mr. Isaacs subsequently received from the directors of the Telefunken Co. a signed statement to this effect, and on November 6th communicated the facts to Mr. Murray, the then Secretary to the Post Office, who undertook to report his complaint to the Postmaster-General. In February, 1915, said Sir Edward, Mr. Isaacs had an interview with Sir Charles Hobhouse, at which Sir Charles admit-

ted that he had gone to the Telefunken Co. and that, looking back, he thought that was a mistake on his part, having regard to his relations with the Marconi Co. On June 28th, 1916, Mr. Pease (then Postmaster-General, and now Lord Gainford) informed Mr. Isaacs that Sir Chas. Hobhouse said there was no foundation for the statement contained in the letter of the Telefunken Co., and that both he and Sir Henry Norman were much incensed at such libellous statements in any letter. In reply, Mr. Isaacs wrote on June 29th, 1916, expressing his astonishment at Sir Chas. Hobhouse's denial of the statement contained in the letter, and pointing out that since he reported the matter to Mr. Murray, on November 6th, 1914, neither Sir Chas. Hobhouse nor Sir Henry Norman had repudiated the statement. On the contrary, early in 1915, Sir Chas. Hobhouse sought an interview with him (Mr. Isaacs), and on two occasions admitted that he did make the offer in question to the Telefunken Co., and that he had since recognised that he should not have done so. "He pointed out that I had my foot on his neck. Did I intend to crush him, which would necessitate his leaving the Government, or would I be disposed to help him?" Mr. Isaacs told him that if a settlement of the contract could be made there would be no reason for the letter to be disclosed, and Sir Charles said he would do his best to bring about an equitable settlement. As a result, the negotiations with the Admiralty were opened. Sir Edward Carson read a translation of the Telefunken letter, which stated that the Postmaster-General and Sir Henry Norman had promised the support of the Government to the Telefunken Co., provided that the latter made offers lower than the Wireless Co.; but the Telefunken could not do this, and therefore Sir Henry Norman approached Herr von Lepel with the object of encouraging him to form an English company. Sir Edward considered the letter of great importance as throwing light on the delays which took place.

Sir F. E. Smith stated that Sir Chas. Hobhouse gave a most specific and positive denial to the statements of fact contained in the Telefunken letter.

After further argument, Sir Edward submitted that the company was entitled to a declaration that the Postmaster-General was not entitled to repudiate the agreement, and that there must be an inquiry to assess damages. He submitted that that assessment should be on the basis of six stations, and should be calculated without any reference to the letter of January 21st.

Sir F. E. Smith (Attorney-General), intervening, said that he and his learned friend the Solicitor-General had taken throughout the view that it was extremely difficult for the Government to contend that there had not been a breach of the contract, for which the Government was responsible. The person who ultimately determined the amount of the compensation should not have his discretion fettered, and therefore the letter of January 21st was for this purpose to be treated as not having been written. Whatever was the real legal situation, in assessing this compensation the basis of compensation should be six stations, and not three.

Mr. Justice McCardie: I think the Crown are acting with great propriety in taking the course which has been announced by the Attorney-General. In my view, that which has taken place in Court will be of the greatest possible utility to the gentleman who has to determine the question of damages. There will be first a declaration that the Postmaster-General was not entitled to repudiate the agreement of July 30th, 1913, and that such agreement in December, 1914, was wrongly repudiated. It will follow upon that declaration that the petitioners are entitled to have damages assessed. It is agreed, as I understand, that the letter of January 21st, 1915, has no juristic relevance to the points which will arise before the tribunal set up to assess damages. It is further agreed between the Crown and the petitioners that the basis on which damages shall be assessed will be that the six stations would have been completed under the contract of July 30th, 1913. Damages will be assessed by some competent expert in a manner which will be agreed between the parties.

His Lordship granted an order for costs.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

In the House of Lords, on 18th inst., a considered judgment was given in the appeal by the British Thomson-Houston Co., Ltd., against an order of the Court of Appeal, which affirmed a judgment of Mr. Justice Astbury.

The arguments were unusually lengthy. Before the trial judge they lasted 10 days, in the Court of Appeal five days, and in their Lordships' House 12 days. The trial was reported in our issues of December 8th, 1916, *et seq.*, and the proceedings in the Court of Appeal in March, 1917.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., and Mr. Gray appeared in support of the appeal; Mr. Thomas Terrell, K.C., Mr. Kerly, K.C., and Mr. Courtney Terrell for the respondents.

Their Lordships, after consideration, dismissed the appeal, Lord Dunedin dissenting.

The Lord Chancellor, in the course of his judgment, said that the action was brought for alleged infringement of a patent (No. 21,513) of 1906 for the treatment and working of metallic tungsten. The question was the validity of that patent, and turned upon Claim 1, which stated that the patentees claimed "the method of working tungsten which consists in subjecting the metal in a coherent form to the action of heat while it is being operated on or manipulated." It was asserted by the appellants that under Claim 1 they were entitled to the exclusive use of tungsten rendered ductile and malleable by this process of theirs for the purpose of working it in the manner described in that claim. His Lordship said: "In my opinion the words 'in a coherent form' in Claim 1 cannot be read as denoting tungsten obtained by the appellants' preparatory process or its equivalent. It was upon this first point that the appellants chiefly relied, as showing subject-matter. In my opinion it fails, and the first claim is, on its true construction, one for subjecting any form of the coherent metal to the influence of heat while it is being operated on or manipulated. The appellants, however, further assert that the application of heat, especially (as they put it) of continuous heat during the process of working, showed invention, and was good subject-matter for a patent. A good deal of evidence was given bearing on this point, and the result is to show that working under heat was the most familiar mode of working metals. It was suggested that the heat so applied was not continuous, but it is obvious that the heat was always renewed as soon as the metal approached the temperature at which it would no longer be workable, and for all practical purposes this amounts to the application of continuous heat. There can be no subject-matter in the application to tungsten of the old process of working under heat, as this does not require any invention. . . . As on my construction of the first claim the use of tungsten in the form produced by the preparatory operation described on page 4, lines 25-35, is not claimed, it is unnecessary to consider whether the process so described was novel, and such as would have supported any patent based upon it. . . . In my opinion the appeal fails."

Lord Dunedin, in differing from the opinion expressed by the Lord Chancellor, referred to the evidence given as to what was the state of common knowledge when the patent was applied for, and said that at that date it was not within common knowledge to indicate any way of drawing tungsten wire to form filaments for electric lamps. The claim was not, as he read it, a claim for the application of heat to tungsten, it was for a process as a whole. He was persuaded that the patentee had made a valuable discovery, and that his claim was so framed as to cover that discovery. Admittedly the industry had practically proceeded on these lines, and these lines alone. He regretted that the judgment to be pronounced would deprive the inventor of the fruits of his ingenuity. For these reasons he thought that the appeal should have succeeded.

Lords Atkinson and Shaw read judgments agreeing with the Lord Chancellor that the appeal should be dismissed.

By a majority, therefore, the appeal was dismissed with costs.

Sulley v. Withers.

In the Lord Mayor's Court, before the Recorder (Sir Forrest Fulton, K.C.), this case was again in the list by way of a motion. It was before the Court a month ago (Elec. Rev., February 22nd, p. 177). The case now came before the Court by way of a motion for a new trial.

Mr. Merlin, for the defendant, said that the case had been settled on terms agreed between the parties.

Mr. Morle, for the plaintiff, said his Lordship would remember that the plaintiff, an auctioneer, sued to recover the amount of a cheque given by the defendant, a customer. Charges of fraud were made against the plaintiff, and while those charges remained on record no settlement could be arrived at. The defendant had consented to withdraw all imputations, and under those circumstances they had agreed to terms by which the debt and costs would be satisfied by instalments. It was not necessary to trouble his Lordship with those terms. A judge's order would be obtained, if necessary.

His Lordship concurred in the settlement.

Bennett *v.* Edey.

In the Bow County Court, before his Honour Judge Graham, K.C., C. B. Bennett, of Sydenham, electrical goods dealer, sued F. G. Edey, of Upton Park, also a dealer in electrical goods, to recover £13 6s. 9d. for goods supplied.

Mr. Harris said £11 12s. 3d. had been paid into court, and the only question was as to the balance, £1 14s. 6d., which represented 46 alleged faulty Baby torch refills retained by the defendant. When the goods were delivered the batteries were in the box, which was sealed, and everything was in perfect order. It said on the box, "We will replace this battery without charge if it depreciates in strength within 12 months, provided the seal is unbroken." The seals had been broken of all those returned by the defendant. If he found them wrong, he should have returned the gross he purchased *en bloc*. He could have tested the batteries with a voltmeter before breaking the seal. He could not return now as he had not observed the conditions of sale.

The Plaintiff gave evidence, and said it was a well-known custom of the trade not to break the seals.

The Defendant said he did test the batteries when they came in, and at once returned 37 out of the gross. He had

to break the seals, as he had to put the batteries in the torches, having purchased them complete at 3s. 2d. He was in a hurry for them, too, for his Christmas trade. Those he put in the torches he thought all right, but they were being returned every day by customers, so he decided to return what he had in hand. He was quite certain they were all old ones made up, but this plaintiff denied. Defendant added that the 25 percentage of bad ones at the start was abnormally high; it was usually two or three.

Judge Graham said the defendant should have returned the lot without breaking the seals, and would have to pay, as he had not done so. There would be judgment for the plaintiff for the full amount claimed, and costs.

Osram-Robertson Patents Litigation.

In the Chancery Division on March 15th, before Mr. Justice Neville, Mr. Hunter Gray moved for judgment in default of defence in an action by the Osram-Robertson Lamp Works, Ltd., against the Ostro Light Co. Counsel said that the action was for an injunction in respect of infringement of two letters patent, for delivery up, and for an inquiry as to damages. There was no defence, and he asked for judgment.

His Lordship made an order in the usual form.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coil v. Magneto Ignition.

In the current issue of your journal you report on the increasing number of American automobiles fitted with coil ignition. While I agree that this is mainly due to the fact that nearly all the cars are now supplied with dynamos and batteries for lighting purposes, is it not an established fact that a good system of coil ignition is superior to magneto?

I have not heard a discussion on the subject by electrical engineers or ignition experts, and, if your valuable space permits, I venture to say it would be both interesting and profitable, especially as ignition plays such an important part in the engineering of to-day.

E. G. Ford.

Seven Kings, *March 18th*, 1918.

WAR ITEMS.

Trading with the Enemy.—The *London Gazette* for March 15th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Uruguay, Bolivia, Brazil, Chile, Denmark, Honduras, Mexico, Netherlands, Norway, Spain, and Sweden.

German Coal Shortage.—In the course of an article on "Problems Facing the German People," the *Birmingham Daily Post* quotes information gleaned from the German Press. In regard to coal, the writer says:—"Difficulties arising from the shortage of coal, and consequent new restrictions on consumption, are reported from most of the large towns, including Berlin, Munich, Dresden, Hamburg, Bremen, Stettin, &c. The Imperial Coal Commissary has issued an official intimation that the coal quota for electric works will have to be reduced to 70 per cent. of the intended amount. In Berlin the tramway service has been drastically reduced, and in Munich it has been cut down to one-third. In Dresden and other towns fresh restrictions have been imposed on the use of electric power and electric light. In some towns no gas is supplied during the day, and in others the gasworks have actually had to resort to the use of wood, while complaints of the poor quality of the gas are universal. South Germany continues to be especially poorly provided with coal. Munich, for instance, is receiving only 1,400 tons a day, instead of the promised quota of 2,000, and the Bavarian Press is full of protests against the alleged discrimination practised against Bavaria."

War Loan Subscriptions.—Amongst the electrical and engineering firms who distinguished themselves during "Business Men's War Loan Week," was Callender's Cable and Construction Co., Ltd. The employés at their Anchor Works, Leigh (Lancs.), set out to raise £10,000 towards the Leigh Submarine, and adopted as their motto:—

> As the Anchor is the hope of the Ship, so the Leigh Submarine will be safe if the "Anchor" does its duty.

The result was a total subscription of over £25,000, of which the firm contributed £7,345. The Mayor congratulated the Anchor Works on being the largest subscribers in the town.

Exemption Applications.—At the Shoreditch Tribunal, Messrs. Jeremiah Rotherham & Co., Ltd., appealed for H. Frantzmann, aged 39 years, classed C 3, superintendent electrician, for the second time, on business grounds. The chairman said he believed this to be a certified occupation. Capt. Weber: If he is the only one on the firm it would be so. Capt. Fisher said the man would be looking after the electric lights of this big firm, which was work of importance. The Tribunal granted six months.

At the Shoreditch Tribunal, James Hoyle, ironfounder, appealed for A. T. Hoyle, aged 26 years, grade 3, an ironmoulder, on business grounds. He was stated to be making steel castings for electrical fittings. All electrical work could be considered of national importance at the moment. All the work of the business was on Class A certificates. The applicant had only two men left now. The Tribunal granted six months.

Before the County Appeal Court, the National Service representative appealed against exemption to A. Hunter, a stoker at the Carlisle Corporation electricity works. Major Hope Brown stated that the man had held a protection certificate, but that had been withdrawn. A further application had been made to the Ministry of Munitions by Mr. Purse, but he understood that they had definitely refused to entertain it. In the case of a man who had had a protection certificate withdrawn, the local tribunal ought not to have granted an exemption on occupational grounds. Mr. Purse stated that he had received no direct information from the Ministry of Munitions, and his application was refused, although he had written personally, but he believed that the Ministry could not have appreciated the difficulty that was being experienced in the City, or they would have adopted a different attitude. In reply to the clerk, Mr. Purse said that substitutes would not stay on the works, and they were each paid £3 3s. per week. The Court adjourned the case for further information from the Ministry of Munitions.

At Rochdale, the Corporation Tramways Committee appealed for R. C. Kelsall (27, Class A), driller, but the man was directed to join up forthwith.

At Maidstone, Mr. Oswald Jones, electrical engineer, appealed for exemption for E. Wicks (28) and W. H. Brown (38), electricians. Mr. Vaughan Gower explained that if the two men were doing certain work, they could be protected, and to enable Mr. Jones to make the necessary application the appeals were put back.

At High Wycombe, Mr. H. S. Broom appealed for the retention of J. H. Milner (18), electrical engineer. Exemption was refused, and the calling up suspended for a month.

At Workington, exemption was claimed for an electrician at the blast furnaces (33, Class A), who said that he was working 16 hours per day. Owing to his high category, exemption was refused.

The Reading Tribunal has granted conditional exemption to G. J. Martin (41, B 1), driver on the Corporation tramways.

BUSINESS NOTES.

After-War Electrical Trade and Industrial Banks.—In continuation of its Special Articles extracting parts of the reports of After-the-War Trade Committees, the Board of Trade *Journal* for March 14th publishes notes on the question of financial facilities in regard to the electrical trades. It is stated that while every industry requires for its development the outlay of new capital, that of electrical manufacturing is, perhaps, more dependent than any other on the help of a powerful financial system. "The major part of its activity is connected with enterprises involving heavy expenditure which may not become immediately remunerative, and the concessionaire, inventor, contractor, or manufacturer must, therefore, for such projects as the construction of a new electric railway, the electrification of an existing line, the introduction of new processes and apparatus, or the equipment or extension of a generating or transmission system, have facilities for recourse to financial organisations prepared to stand a temporary lock-up of capital of considerable magnitude." The Electrical Trades Committee state that:—"In Great Britain such facilities do not exist in an adequate degree. Though she is the financial centre of the world, and can claim to be the pioneer in modern engineering, there has never been created any organised co-operation between her finance and her manufacture."

The *Journal* says:—"So far as British joint stock banks are concerned, the Committee consider that their liabilities to the public, large as compared with their capital, forbid their lending, except with a safe margin and on security readily realisable. It is outside the province of such institutions to provide money for an enterprise, whether at home or abroad, involving a heavy and possibly a long immobilisation of funds. In Germany the conditions are totally different. There, a thoroughly organised alliance, offensive and defensive, has been elaborated between manufacture and finance. Banks and manufacturing concerns have common directors, and on the boards of both there sit technical and commercial experts. The banks link themselves together to provide facilities for industrial expansion, and co-operate with each other and with the great manufacturers in forming subsidiary banks and financial institutions for special purposes. The German financiers do not, at the start, attempt to place an enterprise on the market, as is the practice in England. Guided always by expert advice, they seldom touch a project in itself unsound. They find the money themselves or through their allied groups, and, not afraid of a lock-up of capital, wait till success is shown before they [illegible] public.

"The attention of the Electrical Trades Committee was drawn to the balance-sheet for the year 1915 of the Allgemeine Elektricitäts Gesellshaft, the Siemens-Schuckert Co., and the Bergmann Co., which shows cash balances of 6½, 2½, and 1½ millions sterling respec

tively. 'This accumulation of funds,' they consider, 'is recognised as ready and available for peace projects, and the fact emphasises the necessity for financial assistance being at the disposal of British manufacturers.' 'The Electrical Trades Committee is strongly of opinion that the establishment of industrial banks is essential. Such institutions assisted by the advice of expert assessors, would help to protect the public against unsound speculative ventures, and would exercise a profound influence in placing industrial enterprise on a stronger financial basis.'"

Dick, Kerr Turbine Contract for Glasgow.—An important contract for generating plant has recently been awarded to Messrs. Dick, Kerr & Co., Ltd., by the Glasgow Corporation in connection with the new power station which is being erected by the city authorities at Dalmarnock. The contract includes a turbo-alternator set, with condensing plant and step-up transformers designed for a continuous output of 18,750 kw. The turbine will be a single unit standard Dick, Kerr impulse type machine, arranged to run at 1,500 r.p.m., and will operate on steam at 250 lb. per sq. in. pressure at the stop valve, superheated to 650° F., and exhaust into a vacuum of 29·1 in. All overloads will be dealt with by automatic governor valves without recourse to hand operation or by-pass valves, high pressures and temperatures being confined to the cast-steel governor valves and inlet castings. The turbine will be direct-coupled to a 6,500-volt, 25-cycle, three-phase Dick, Kerr alternator, having a maximum continuous rating of 24,000 k.v.a. at 80 per cent. power factor. The machine will be of the self-ventilating type, provided with fans on the rotor drawing the cooling air through a wet-air filter of the Heenan & Froude type. An exciter of the overhung type will be provided. The alternator will be electrically connected to a bank of three Westinghouse single-phase, oil-circulated, water-cooled transformers, stepping up the pressure from 6,500 to 20,000 volts. In connection with these transformers, a separate oil cooler and motor-driven oil circulating pumps will be provided. The turbine will exhaust into a standard Willans & Robinson condenser, having a surface of 26,000 sq. ft. The air extraction plant, in duplicate, will be on the well-known Willans rotary water-jet system, which possesses the merit of great simplicity and ease in operation, combined with great evacuation power. The vacuum will be 29·1 in. with a 30-in. barometer. The extraction pumps, also in duplicate, will be of the usual centrifugal type.

Book Notices.—*Aluminium: Facts and Figures.*—In view of the constantly increasing use of aluminium in a wide range of industries and applications, the British Aluminium Co., Ltd., has prepared a new edition of this useful pocket-book, incorporating additional data with regard to various forms of aluminium, and considerably amplifying the "Hints on the Working of Aluminium." The book is bound on the loose-leaf principle to facilitate the addition or substitution of new leaves when necessary. The data relate to a variety of forms ranging from billets to wire and cable, fuse wire, collector bows, bar and strip, sheet, tubes, drawn sections, and castings, and include particulars as to sags and tensions of overhead lines, corona voltages, paper-insulated cables, joints, &c. The special feature of the present issue which we most cordially welcome is the adoption of metric weights and measures "in anticipation of extended trade in countries in which the metric system is exclusively used"; moreover, the data are given in accordance with common sense and with the requirements of commercial practice, in that in no case are more than four significant figures employed. Wire, rod, strip, sheet, and tubes are tabulated in even metric sizes. In the present instance the facts and figures are given in both English and Spanish, in separate sections. The pocket-book, which can be obtained from the company (price 4s.), will be of great use in many quarters of the world.

"Electricity Meters: Their Construction and Management." By C. H. W. Gerhardi. London: Benn Bros., Ltd. Price 15s. net.

"The Theory of Electricity." By G. H. Livens. Cambridge University Press. Price 30s. net.

"Aviation Engines." By Lieutenant V. W. Pagé, U.S. Air Service. London: Crosby Lockwood & Son. Price 15s. net.

For Sale.—King Lynn Corporation Electricity Department has a battery of 220 cells for disposal. For particulars see our advertising pages to-day.

Trade Announcements.—Mr. E. C. Beman, managing director of the E.S. Co., Ltd., having been refused further exemption, has resigned his seat on the Board and disposed of his entire interest in and terminated his connection with the company, which he founded in 1913. His co-director and fellow shareholder (Mr. Vernon H. Wells) has been for the past 15 months engaged on active service in the R.F.C., and is at present in Mesopotamia. Satisfactory arrangements have been made for the continuance of the business under efficient management.

Messrs. Cunningham, Slater, Ltd., ask us to state that Mr. A. J. Cunningham was the founder of Harraway Bros. and director and secretary to Harraway Bros., Ltd., electrical engineers. Mr. A. J. Cunningham and Mr. J. Wynn Slater have joined forces, and in future the business will be known as Cunningham, Slater, Ltd., with branches at 45, King's Road, Chelsea, and 146, Kensington High Street, W., the latter being the head depôt and registered offices. All assets and liabilities will be carried over. Mr. Cunningham and Mr. Slater both hold commissions as Lieutenants, the former in the Royal Naval Reserves and the latter in the Army.

The Russo-British Chamber of Commerce has taken new offices at Cross Keys House, 56, Moorgate Street, E.C. 2, the Government having requisitioned its Kingsway premises.

Miners' Safety Lamps.—The Home Secretary has issued the Safety Lamps Order, dated March 9th, approving of several types of Patterson flame safety lamps, the Davis-Briggs oxymeter officials' lamp, and the Joel-Fors electric safety lamp (type 303 M). The specification of the Ceag miners' electric safety lamp is amended and consolidated.

British Industries Fair, 1918.—At the Pennington Street warehouse of the London Dock, on March 11th, the fourth British Industries Fair organised by the Board of Trade since the outbreak of war was opened. Admission to the Fair is again confined to *bonâ fide* trade buyers for home and oversea markets, and the B. of T. has issued invitations to some 60,000 firms in this country. As in former years, British firms only are permitted to exhibit, and no manufacturer may exhibit articles other than those of his own manufacture. Some 425 firms are exhibiting this year, and in order to avoid any interference with military requirements the Fair has again been confined to the following industries:—Pottery, glass, stationery, paper printing, fancy goods and toys. None of the engineering trades are represented, and the only electrical exhibits are such articles as pocket lamps, torches, hand lamps, &c., with dry cells and batteries for the same. Interpreters are in attendance at the offices of the Department, where general commercial information can be obtained. The Fair closes to-day.

Calendar.—We have received a large wall calendar from the Anglo-Mexican Petroleum Co., Ltd., of 16, Finsbury Circus, E.C. 2. Monthly slips and complete calendars for 1918 and 1919 centre in a design in colour showing oil works and storage and oil applications.

Lady Footballers.—On Saturday last the Lady Footballers connected with the Sterling Athletic and Social Club (Sterling Telephone and Electric Co., Ltd.) accomplished one of their best performances of the season in defeating the previously undefeated Marconi Ladies, from Chelmsford, by five goals to nil. During the season the Sterling Ladies, who are undefeated, have scored 78 goals to eight.

Liquidation.—Monometer Manufacturing Co., Ltd.—Meeting of creditors, March 26th, at 26, Corporation Street, Birmingham. Liquidators, Messrs. H. T. C. S. Ledsam & G. G. Poppleton.

List.—Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—List of dynamos and motors held in stock for immediate delivery.

Economising High-Speed Steel.—Drawing attention to the imperative necessity for economy in the use of high-speed steel, the Macadam Electrical Engineering Co., of 49, Deansgate, Manchester, remarks that great difficulty has been experienced by the manufacturer and the engineer in trying to comply with this in their own restricted spheres, causing great expense and retardation to manufacture. The company states that it is in a position to assist them to attain that most desirable object without any great expenditure, complications in design, or loss of time. This can be accomplished with a saving of 75 per cent. of high-speed steel in practically all tools, simple or complex, at a very small outlay.

LIGHTING AND POWER NOTES.

Aberystwyth.—Hydro-Electric Scheme.—The T.C., on March 12th, discussed the question of an electrical supply for the town, it being proposed to use power from the river Rheidol. Ald. T. J. Samuel suggested that they should invite a first-class electrical engineer to inspect the different sources of power available. The matter was adjourned for further consideration by the Public Works Committee.

Ammanford.—Price Increase.—The Electric Supply Co. has asked the U.D.C. to consent to the charge for electricity to private consumers being advanced by 1d. per unit.

Ardee (Co. Louth).—Workhouse Lighting.—The Poor Law Guardians have accepted the offer of the Ardee Electric Co. for the supply of additional lamps in the workhouse.

Bantry.—The Town Commissioners have agreed to pay the contractor for public street lighting an increase of 20 per cent. on pre-war rates.

Bedworth.—Street Lighting.—The Parish Council has accepted the offer of the Leicestershire and Warwickshire Electric Power Co. to light the whole of the street lamps for 12 months at £3 10s. each, 30-c.p. lamps to be used if 50 and 100 c.p. are unobtainable.

Belfast.—Extension Scheme.—At a special meeting of the Corporation on Friday last, the report of the Tramways and Electricity Committee, on the proposed extension of the electricity undertaking, was considered. The Committee stated that it received an intimation that Messrs. Workman, Clark & Co. would require a large increase of electric power for their shipyards, and asked if the Corporation was likely to be able to furnish the supply on such terms as would make it unnecessary for the firm to install any further generating plant.

The Committee consulted Sir John Snell, who advised that the

Corporation should give the supply to Messrs. Workman, Clark and Co. If the Corporation declined this responsibility, then it must give up all hope, in his opinion, of developing the undertaking. The power supply to Messrs. Workman & Clark was a critical point in the policy of the electricity department. If the proposed new supply were granted the maximum load would not be less than 12,850 KW., and the plant installed gave a maximum output of 17,300 KW., leaving (on paper) 4,450 KW. spare plant for three classes of supply—traction, general D.C., and the A.C. supplies.

The Corporation would, however, he felt sure, see that there was no alternative policy, and would decide (1) to give the shipyard supply, and (2) to install the necessary additional plant by the autumn of 1919. He would prefer to put the plant into East Bridge Street, but there were difficulties in the way of this project which would, in his mind, eventually mean wasted capital. The alternative was to put both 6,000-KW. sets into a first section of the new harbour station, when many of the present difficulties connected with East Bridge Street would disappear. From an engineering and from a development point of view there was no doubt this was the proper and right policy. But it meant a larger expenditure of capital now, and there would be difficulty in getting steel for the power house building and lead for the extra cables required.

The alternative figures given by Sir John were:—New station on Harbour Estate, £310,750; East Bridge Street as altered, £126,000. This scheme would be in substitution for the £60,000 authorised by the Corporation in January last.

The Committee recommends the adoption of the scheme, and also that the services of Sir John Snell as consultant be retained at a fee of 2½ per cent. on the amount of work executed, exclusive of cost of buildings and reinstatement of paving work.

The discussion, which had been twice postponed, lasted two hours, and eventually it was resolved to adopt Sir John Snell's scheme, and application is to be made for sanction to borrow £310,750 for that purpose.—*Northern Whig.*

Birkenhead.—PRICE INCREASE.—The T.C. has increased the price of electrical energy as from April 1st as under:—Ordinary consumers for lighting, by a further 12½ per cent.; prepayment meters, an increase of ½d. per unit; ordinary power consumers, a further advance of 10 per cent. For the present there is no increase for heating and cooking.

Blackpool.—PRICE INCREASE.—The Electricity Supply Department has given notice that, from the commencement of the June quarter, there will be a further increase of 5 per cent. on all electricity accounts.

Continental.—GERMANY.—A communication to the *Norddeutsche Allgemeine Zeitung* from Munich points out that the main economic problem which will confront Bavaria after the war is the problem of industrialisation. Bavaria possesses little coal but much water power, which has not hitherto been utilised on a large scale. The coal consumption of Bavaria previous to the war was, on an average, ten million tons per annum, and the coal produced in the country only amounted to three million tons. It was, therefore, necessary to import something like seven million tons every year, and it is clear the coal and transport problems would have been much easier during the war had Bavarian water power been fully utilised for the production of electrical energy.

In 1913 the electricity consumption of Bavaria to the right of the Rhine was only 360 million KW.-hours, or less than one-half of that required by the Imperial Nitrate Works alone. This comparison gives an idea of the present extent of the electricity demand of Bavarian industry.

Despite war conditions, the project of the Bavarian Electrical Works put forward some time ago has recently entered upon a critical stage. If this project is realised, the whole of Bavaria to the right of the Rhine will be traversed by transmission networks at a pressure of 100,000 volts, which will be fed by the State—through the projected Walchensee Works and the Lech Works to be established later on—the energy to be purchased by the great Overland Works and the Bavarian towns. During the summer the hydro-electric stations in the south generate more than they can utilise; they will, therefore, feed the transmission lines, which in turn will distribute to works dependent on coal. In winter the situation will be reversed, and the steam stations — primarily those situated in the neighbourhood of coalfields—will have to supply the deficiency from which the hydro-electric stations suffer as a result of low water.

It is stated that the Bavarian Minister of the Interior is to discuss the plan with the interested parties in the immediate future, and the proposal is to establish the Bavarian Electricity Works as a partly public and partly private undertaking, with a capital of about 30 million marks, half of which will be issued in the form of shares and the rest in bonds. Of the 15 millions the Bavarian State will take over about six million marks, the Overland Works a further three million and the larger towns altogether about three million marks. This Walchensee project, which was first put forward many years ago, will be carried out after the war.

What attitude Bavaria would adopt towards a possible Imperial monopoly of electricity is not known. The Bavarian Minister of the Interior recently stated in the Diet that nothing was known to him "at present" of any intention to introduce an Imperial monopoly, and he declared that Bavaria must in any case reserve the right of disposal over her own water power, and that he intended to exploit this water power as fully and as soon as possible.

ITALY.—A deficiency in the supply of electricity furnished by hydro-electric works, arising from the lack of autumnal rains last year, has led the Under-Secretary of State, at a recent public meeting, to announce a number of proposals for the increase of production. Among these is the rapid completion of a number of important hydro-electric schemes in course of construction, the linking-up of electric-generating works in remote regions with the main supply, the reduction of the use of energy for lighting and tramway traction, domestic lighting, and other voluntary uses, and the limitation of supply to various industries to so many days per week. In Piedmont, where these arrangements have been put in practice, the regulations instituted prescribe a seven days' supply of electric current for the lighting and traction services, daily newspapers and munitions factories; six days' supply to mills, bakeries, steelworks, industrial chemical works, &c.; five days' supply to rubber works, aircraft builders, automobile builders, &c.; four days' supply to engineering works, textile works, carriage builders, bootmakers and military furnishers, sawmills, cabinet making works, printing houses, &c., and three days' supply to film makers, chocolate manufacturers, &c.

Cork.—ELECTRIC TRAMWAY AND LIGHTING CO.'S LEASE.—At a meeting of the Corporation, the City's Electric Lighting Provisional Order and a report from Mr. J. P. Tierney, M.Inst.C.E., on the present condition of the plant and equipment for the electrical supply of the city were considered.

The City Law Agent (Mr. Galvin) said the lease to the present company (the Electric Tramway and Lighting Co.) for the electric lighting of the city would expire in a few months, and the first question the Corporation had to consider was whether it would be willing to take over the undertaking, or, if not, to ascertain upon what terms the company would be prepared to come to an agreement as to the future. In the report it was stated that the engineer understood that Messrs. H. Ford & Sons (of U.S.A.) contemplated erecting their own power station in their works, and that, as far as information went regarding the size of the works, it would appear that the demand there would be equal to the demand for the whole of the rest of the city. Messrs. Ford had the best site for a power station, because large colliers could come alongside, thereby enabling coal-handling plant to be erected to convey coal direct from the ship's bunkers to the bunkers at the station, while the site was also an admirable one from the point of view of condensing water. The question was one involving a large number of interests, but, taking a broad view of the situation, it seemed to the engineer that it was of the utmost importance to the industrial development of Cork that there should be one large power station situated in the best position for both coal and water, so that, with modern plant, they might be able to generate at a low figure, and to supply at a cheap rate for industrial purposes. Mr. Galvin advised that, in all the circumstances, a small Committee should be appointed to go into all details, and report to the Council.

The suggestion was adopted, and two members from each ward were appointed to form the Committee.

Dartford.—BULK SUPPLY.—The U.D.C. has given notice to the West Kent Electric Co. that it will not in future supply energy under the contract beyond 600 KW. unless the company agrees to pay as from the date when the maximum of 600 KW. was exceeded until the termination of the contract certain additional charges. Since October last the demand of the company has been considerably in excess of 600 KW., resulting in an increased loss to the undertaking.

Dover.—LOAN.—The T.C. has, instead of borrowing from the bank, utilised the sinking fund as a loan to the electricity undertaking at interest, as if the money were invested.

Dundalk.—ANNUAL ESTIMATES.—The estimate of Mr. P. A. Spalding, engineer and manager to the U.D.C. electricity department, for the ensuing financial year, shows a deficit of £11 after meeting interest and sinking-fund charges on capital loans, and states that, but for anticipated economy in the use of ignition oil, the deficit would have been £800. Mr. Spalding recommends that the contract for town lamps be increased by one-sixth as from April 1st, making a total increase of 33⅓ per cent. on the pre-war contract.

Ebbw Vale.—STRIKE.—All the electricians of the Ebbw Vale Co. and the Ebbw Vale District Council have struck for higher pay.

Edinburgh.—The Corporation Electric Lighting Committee, on Friday, considered the situation with regard to the position of the proposed power station at Portobello, on which work has been almost suspended since the outbreak of the war. New questions have arisen in connection with the report of the Sub-Committee of the Coal Conservation Committee, which suggests the establishment throughout the country of super-electric power stations to supply the whole kingdom. One of these, it is suggested, might be erected at Newcastle, which would be able to supply the most of Scotland, and thus obviate the necessity of erecting the Portobello station. At Friday's meeting, Sir Alex. Kennedy, who was present, explained matters to the Committee, and it was agreed to instruct him to prepare plans showing the immense possibilities of the Portobello station, and that it fulfils all the requirements of the Coal Conservation Committee for the erection of a big super-station capable of supplying an almost unlimited area, and that this should be submitted direct to the Minister of Munitions, and permission be asked to begin operations on the station.

The Corporation electrical engineer reports that there is now an extra-high-tension converting plant at McDonald Road station, and that with the provision of the necessary switch gear at Dewar Place station he will be able to effect a considerable economy during the four or five summer months. The saving is expected to be over £1,000 a year.

Gillingham (Kent).—Plant Increase.—The T.C. has by 12 votes to 6 rejected a recommendation to install at the electricity works an additional Diesel engine, &c., at an estimated cost of £12,000. The Kent Electric Power Co., who had been approached, had found it impossible to assist the Council in its difficulty by giving a part supply of energy in bulk.

Hereford.—Loan Application.—The T.C. has applied to the L.G.B. for sanction to a loan of £9,000 to meet over-expenditure for plant, &c., at the E.L. works, caused by great increases in wages and cost of materials since the first letting of the contracts.

Huddersfield.—The employés at the electricity works have passed a resolution in favour of electricity workers, enginemen, and firemen taking their place in the ranks of organised labour, with an immediate object of asking for an increase of £1 per week over pre-war wages and the 12½ per cent. bonus.

Lourenco Marques.—The Electric Light Co. has informed the Municipality that it is prepared to reduce meter rents, which now stand at 4s. monthly, by 20 per cent., and the price per unit, which is now 2s. 3d., by 10 per cent. The Municipality is not, however, willing to accept these terms, and is proceeding to obtain powers and funds to expropriate. All the local bodies support the Municipality in this matter.

Lye.—Street Lighting.—The U.D.C. has decided to have installed by the Midland Electric Light Co. eight public electric lamps, which will replace those lit by gas.

Ormskirk.—Price Increase.—It has been decided to increase the charges for electrical energy for lighting, heating, power and other purposes, as from March 31st, by a further addition of 10 per cent. to the present charges.

Newquay.—Proposed Prov. Order.—The Electric Light and Power Co., Ltd., is to apply to the B. of T. for a prov. order to raise the prices as follows: for any amount up to 12 units, 10s., and for each unit over 12, 10d.

Salford.—Year's Working.—The financial results for the year ended March 31st, 1917, show a total income of £155,813. The working costs—including energy purchased—amounted to £84,334, leaving gross profit of £71,479, which equals 9·4 per cent. on capital expended. After payment of interest, £17,725, and sinking fund, £32,400, there remained a net profit of £21,354. From the net profit £12,000 has been allocated to the relief of the rates, and the remainder, £9,354, to the depreciation and renewals funds. The gross and net profits are the largest recorded in the history of the undertaking. Electrical energy sold for all purposes amounted to 29,572,331 units, against 24,856,435 units the preceding year, an increase of 20 per cent. The energy sold for lighting shows a slight decrease, but there is an increase of 13 per cent. in the supply for traction and 27 per cent. in that for power purposes. The total increase in cost of production, due to abnormal conditions, amounts to £27,500. On the other hand, increased revenue, due to advanced rates, amounts to £13,300. A sum of £24,227 was expended during the year on capital account, of which £22,844 went to machinery at Frederick Road, £519 on substations, and £863 on mains and services. The capital account now stands at £620,304. There has been a saving of £17,000 in fuel alone, while the reduction in oil, stores and repairs can be taken as £2,500 per annum. This saving is almost entirely due to the increased efficiency of the modern plant recently completed, which, although supplied since the outbreak of war, was purchased at extremely favourable prices.

South Africa.—Bloemfontein.—Owing to one of the heaviest rainstorms ever known in the history of Bloemfontein, the municipal electrical power station recently became flooded, and it was necessary to shut down the plant for 48 hours. The tramcars came to a standstill and the streets were in darkness.

Paarl (Cape Province).—The ratepayers, at a public meeting convened for the purpose, unanimously resolved to adopt the proposal of the Town Council to extend the electric light installation at an additional expenditure of £2,200. The Mayor stated that the extension would yield a profit of 18 per cent.; 320 premises are now supplied with electric light, giving the municipality a revenue of £3,000 per annum.

Southport.—Year's Working.—The Electricity Committee reports a loss of £890 on the undertaking for last year, against a profit of £2,682 for the previous year. The loss is attributed mainly to the extra cost of coal and war bonuses to workmen.

South Shields.—Year's Working.—The revenue for the year ending March 31st, 1917, amounted to £32,370, an increase of £1,632, or 5·3 per cent. compared with the previous year. The bulk of this increase is accounted for by power consumers, from whom the gross revenue obtained amounted to £11,168, an increase of £1,828, or 19·5 per cent. The revenue derived from electricity used for heating purposes is £767, an increase of £228, equivalent to 12·5 per cent. over the corresponding figure for the previous year. Revenue obtained from energy sold for lighting purposes is practically stationary, being £2,224 less than in normal times. Working expenses amounted to £18,829, a net increase of £1,606, or 9·4 per cent., and there is an increase of £801 for income-tax. In spite of these increases the works costs have been reduced from 0·57d. to 0·56d. per unit, and the total costs from 0·912d. to 0·909d. per unit. During the whole war period the fuel costs have been less than previously, this being due to the new boiler plant, which enabled a very low grade of fuel to be [illegible]. The gross profits amount to £13,541, an increase of £36, or 0·2 per cent. Capital expenditure stands at £227,717, the total expended during the year being £2,619. There has been no increase in tariffs over pre-war rates, but there has been a deficit on the year's working for the past two years. This has been met out of the reserve fund, which now stands at £12,189, equivalent to 5·3 per cent. of the capital expenditure, without unduly decreasing the reserve, or increasing the tariffs.

Stamford.—The T.C. has granted permission to the Electric Light Co. to erect an overhead cable along the side of Ryhall Road, to Messrs. Martin's works.

Whitehaven.—Loan Application.—The Lighting Committee of the T.C. has decided, in view of the increased demand for power, to apply for sanction to a loan of £2,000 for the installation of a 200-kw. generating set.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—Under the new award affecting tramway workers, Accrington Corporation will be involved in an additional expenditure of between £1,800 and £2,000 a year. Compared with pre-war rates, the wages at present paid have increased by £6,000 per annum.

Birmingham.—Bonus Question.—A week ago the Committee on Production decided to grant the 12½ per cent. bonus to the workmen employed in the gas and water departments and the men engaged at the tramway depôts, as from February 13th. The men objected to this, as the 12½ per cent. award to the munition workers (including Corporation electrical employés) was dated October last, and at a mass meeting decided to come out on strike at the end of the week if the payment were not made retrospective to last autumn. On Friday conferences took place with the Salaries and Wages Committee of the Corporation, and the result was, after a withdrawal of the strike notice by a large deputation of the operatives, to leave the matter for settlement to the Lord Mayor (Ald. A. D. Brooks). He decided in favour of altering the date for the payment of the bonus to December 15th, and this decision was received with cheers. The motormen and conductresses on the tramways were not included in the award of the Committee on Production, and it was agreed to make at once a joint application to that Committee to make an award without delay.

Bradford.—Tramways Strike.—The Corporation tramcars were brought to a standstill last Saturday morning, the employés deciding on a strike at the end of the Friday night service. The trouble has been brought about by the women employés, who contend that they are entitled to the full extension to £1 per week bonus above pre-war wages recently awarded to men transport workers. The women who have replaced men are paid the same wages as the men. The contention of the Tramways Committee is that as the bonus paid to women is different to that of the men, they should receive only the same advance as that just granted by the national award to the men, which in the case of the Bradford workers is 4s., the difference between 16s. and the new figure of £1. The women's bonus was 9s., so that, granted an advance of 4s. like that which brings the men up to £1 above pre-war rates, the women get 13s. above those rates. Both parties have now agreed on an appeal to the Committee on Production, but a settlement is hindered by a demand issued on Sunday that the Committee on Production should give its promise within three days to deal with the matter.

Continental.—Switzerland.—The electrification of the Scherzlingen-Berne and Brigue-Sion lines has just been approved by the Administrative Council of the Swiss Federal Railways. This electrification is to be carried out as speedily as possible; it will require 17 electric locomotives and involve an outlay of 9,700,000 fr. Another scheme, having in view the electrification of the whole of the Swiss railways by means of hydro-electric energy, is also under consideration. The estimated outlay is put at 500,000,000 fr. The Swiss Federal Railways Administration is specially bent on the realisation of this scheme, in order to free the Republic from dependence on Germany for imports of coal, with its contingent political embarrassments.

Italy.—The details of the electric railways from Pracchia to San Marcello Pistoiser are definitely settled as follows:—The line will be of the normal gauge, and it will put into communication with Porrethana the numerous centres which have their head at San Marcello, and facilitate the service of important industrial establishments such as those of Cartierelini, the Metallurgica Italiana, the Gamberini foundries, &c. The length of the line will be about 15 kilometres; starting from Pracchia it will cross the river by an armoured concrete bridge 56 metres long, and in about the middle of the course will pass under Mount Oppio by a tunnel 556 metres long, thence continuing to Limestre and its terminus at San Marcello. The equipment will comprise 12-metre Vignoles rails, of a weight of 12,500 kg., the system of traction being continuous current at about 800 volts. The electric power will be drawn from the works of the Società Ligure-Toscana. The cost of the undertaking is estimated at 3,000,000 lire, with rolling stock costing 500,000 lire.

Dublin.—Wages and Discontinued Services.—The United (Electric) Tramways Co. has issued a statement to the effect that inquiries made from the Committee on Production and at the Ministry of Labour show that it is not bound by the terms of the award of 20s. a week on pre-war rates to the employés of English companies. The company holds that it would be manifestly inequitable if the same war advances applied in existing circumstances to Great Britain and Ireland, pointing out that the conditions differ in British centres. The directors have again considered the war wages question, and have decided to give a further advance of 4s. per week to motormen and conductors, making an increase of 12s. 6d. and 13s. on pre-war rates. The men have been advised by their Union officers to accept the 4s. advance, but it is understood that if the Government do not fix an arbitration date, a fresh notice to stop work in seven days will be handed in on a claim for the full £1 advance on pre-war rates.

On Monday notice was given that in consequence of the urgency of conserving coal supplies, the company is compelled to reduce the services as from Thursday, 21st inst.

The Transport Director announces that owing to the tonnage difficulty a diminution of 1,000,000 tons a year in the Irish coal supply, or about one-fourth of the usual supply, is expected, and a Committee of the principal importers and users is to take in hand the proper apportionment of supplies.

Higher Fares on Tramways.—In connection with the recent award by the Committee on Production to tramway workers, the following resolution was adopted at a preliminary conference of tramway employers and Unions called by the Chief Industrial Commissioner:—"That Sir George Askwith be asked to obtain from the War Cabinet an undertaking that they will take immediate steps to authorise the increase of the maximum tolls and charges, whether statutory or otherwise, which may be demanded on all tramways or light railways, by an amount to be decided by the Board of Trade." This resolution was signed by Mr. J. B. Hamilton, representing the Municipal Tramways Association; Mr. R. J. Howley, representing the Tramways and Light Railways Association; and Mr. R. Williams, secretary of the National Transport Workers' Federation, representing the men's Unions. The resolution indicates that all parties to the arrangement are agreed that the advances necessitate an increase in fares on tramway systems.

Leeds.—Wages.—The terms of the award of the Committee on Production are to be applied immediately to the drivers and conductors on the Leeds tramways. Drivers who received 37s. 6d. pre-war wage and 15s. war bonus will now have their bonus increased to £1; women conductors who received 27s. 6d. + 12s. war bonus will have their bonus increased by 4s. The question whether the award is to apply to women who do not yet participate in the war bonus is to be referred to the Committee on Production.

Railway Workers' Wages.—The Executive of the National Union of Railwaymen has decided to apply to the Railway Executive for a further advance in wages to the employés of British railways. This application is an outcome of the 12½ per cent. increase conceded to the general body of workers coming under the munitions trades, and railway workers now claim to be placed on terms of equality with other workers.—*Daily Telegraph.*

TELEGRAPH AND TELEPHONE NOTES.

Leeds.—Mr. T. B. Johnson, the superintendent engineer of the telephone department at Leeds, states that unless an unexpected hitch occurs to check progress, the change to the automatic system will be made in Leeds in May.

Spain.—On the promulgation of a decree dissolving societies of employés of Government Departments, last week, the whole of the employés of the Posts and Telegraphs refused to submit to it, and the telegraph service throughout the country came to a standstill, except in isolated cases. On Saturday the telegraph service was placed under military control, and the telegraph offices were occupied by troops. Decrees were also published in the *Official Gazette* dismissing the employés of the postal and telegraphic services, who will be mobilised under military law.

On Monday the Government settled the dispute by granting all the demands of the employés.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Aberdeen.—April 9th. Electricity Department. One 5,000-kw. turbo-alternator, surface condenser, and auxiliaries. See "Official Notices" to-day.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Darlington.—March 29th. Electricity Committee. Water-tube boiler, economiser, cooling tower, fan, and feed pump. See "Official Notices" March 15th.

Eastbourne.—March 25th. Electricity Department. Six or twelve months' supply of pea or slack coal. See "Official Notices" March 15th.

Edinburgh.—March 30th. Electric fittings, &c., for Midlothian and Peebles District Asylum, Rosslynlee. Clerk and Treasurer, 19, Heriot Row, Edinburgh.

Halifax.—March 26th. B. of G. Electrical fittings for six months. Mr. A. T. Longbotham, Clerk to the Guardians, Carlton Street, Halifax.

Manchester.—March 27th. Electricity Committee. Supply and laying of 33,000-volt E.H.T. cable. See "Official Notices" March 8th.

April 2nd. Corporation Electricity Committee. For Moss Side sub-station. Three 3,000-K.V.A., 33,000-volt, three-phase, static transformers. Specifications, &c., from Mr. F.E. Hughes, Electricity Department, Town Hall.

March 25th. L. & Y. Railway Co. Various stores for 12 months, including: (36) Signal, telegraph and electrical fittings. (37) Signal, telegraph, and electric light wires. (44) Siemens and electrical steel sheets. Mr. Waring, Stores Department, Osborne Street, Manchester.

CLOSED.

Government Contracts.—List of new contracts placed in February, 1918.

War Office.

X-Ray accumulators.—Premier Accumulator Co., Ltd.
Dynamos.—Brush Electrical Engineering Co., Ltd.; Electric Construction Co., Ltd.; General Electric Co., Ltd.; Rhodes Motors, Ltd.; Newtons, Ltd.
Generating sets.—Brownett, Lindley & Co., Ltd.; Electric Construction Co., Ltd.; Petters, Ltd.; Siemens Bros. & Co.
Motors, &c.—Electric Construction Co., Ltd.
Electric light set.—Coventry Simplex Engines, Ltd.
Electric switchboards.—General Electric Co., Ltd.
Steel tubes.—Stewarts & Lloyds, Ltd.
Iron wire.—R. Johnson & Nephew, Ltd.; Rylands Bros., Ltd.; Shropshire Iron Co., Ltd.

India Office. Store Department.

Brass tubing.—Earle, Bourne & Co.
Copper wire.—J. Wilkes, Son & Mapplebeck.
Tubes.—Stewarts & Lloyds, Ltd.; British Mannesman Tube Co.

H.M. Office of Works.

Engineering services.—H.M. Fuel Research Station, East Greenwich.
Electric push-button goods lift.—Aldous & Campbell, Ltd.

Post Office.

Repairing wire apparatus.—Wynn, Timmins & Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Battery boxes.—W. D. Tucker & Sons, Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—B.I. & Helsby Cables, Ltd.; General Electric Co., Ltd; W. T. Glover & Co., Ltd.; Henley's Telegraph Works Co., Ltd.; India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cable.—Peel-Conner Telephone Works, Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—B.I. & Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Western Electric Co., Ltd.
Terminal irons.—Walls, Ltd.
Telephone lamps.—General Electric Co., Ltd.
Distribution cable plugs.—B.I. & Helsby Cables, Ltd.; Henley's Telegraph Works Co., Ltd.
Stay rods.—Bullers, Ltd.; Bayliss, Jones & Bayliss, Ltd.
Insulators, spindles.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.; T. W. Leach, Ltd.
Wire strainers.—S. Venables & Son.
Stay swivels.—Bullers, Ltd.
Telephones.—Gent & Co., Ltd.; Peel-Conner Telephone Works, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. incorporated in the London Electric Wire Co. & Smiths, Ltd.
Galvanised steel wire.—R. Johnson & Nephew, Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 22nd. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Pyrometers and Impact Testing," by Mr. C. E. Foster.

(Midland Section).—Friday, March 22nd. At the Imperial Hotel, Temple Street, Birmingham. At 7.45 p.m. Paper on "Constructional Engineering," by Mr. G. W. Costigan.

Royal Institution of Great Britain.—Friday, March 22nd. At Albemarle Street, W. At 5.30 p.m. Lecture on "Radiation from System of Electrons," by Prof. Sir J. J. Thomson, President R.S.

Saturday, March 23rd. At 3 p.m. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, President R.S.

Physical Society of London.—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Fourth Guthrie Lecture on "The Origin of Spectra," by Prof. J. C. McLennan.

Institution of Electrical Engineers.—(Manchester Local Section).—Tuesday, March 26th. At the Engineers' Club. At 7 p.m. Paper on "The Mechanical Design and Specification of the Turbo-alternator Rotor," by Dr. S. F. Barclay.

Greenock Electrical Society.—Thursday, March 28th. At 7.45 p.m. At 22, West Stewart Street. General meeting. Saturday, March 30th. Visit to McAlpine's Lead Works, Govan.

NOTES.

The Electrical Wages Award.—According to the *Daily Telegraph*, the Minister of Labour averted a stoppage of the London electrical services on Saturday by arranging to secure the payment to electricians of the extra wages granted to them last January, if necessary by Government re-imbursement of the contractors whose contracts did not allow for the extra payments. "The men concerned were City munition workers, who alleged that some of the Government contractors had not made the grant. It was feared that the Tubes, trains, factories, and all services depending upon electrical supply would be interfered with. Happily the intervention obviated this possibility."

Appointments Vacant.—Meter tester (£3), for the Borough of Salford Electricity Department; switchboard attendant (£117 + 12½ per cent.), for the Borough of Nuneaton Electricity Department; senior charge engineer, for the North Metropolitan Electric Power Supply Co., St. Albans; charge engineer, also engine-driver (40s. to 45s.), for the Dover Corporation Electricity Works; switchman (65s. 6d. + 12½ per cent.), for the City of Birmingham Electricity Supply Department; mains foreman (60s. + 12½ per cent.), for the Londonderry Corporation Electricity Department. See our advertisement pages to-day.

Chief Technical Assistants' Association.—The Hon. Secretary of the Chief Technical Assistants' Association informs us that the Executive Committee is giving the question of the membership of the senior technical officers of the undertakings outside Greater London every attention, and it is hoped very shortly to submit proposals to those interested. In the meantime, the senior technical officers of the grades eligible for membership, who have not yet communicated with the hon. secretary, should do so; apart from the advantages of all senior technical officers in the United Kingdom being associated, and, consequently, having a medium for the interchange of information and other matters, the formation of the new Association or Institution can be materially assisted by the existing Associations, and on this ground alone, if not on any other, all senior technical officers should put themselves forward for election to membership, with a view to obtaining the requisite representation in connection with their professional status and appointments, before, or on, the Committee or Committees which may undertake the drafting of the articles of the new Association or Institution.

Foreign Trade.—The February Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	February, 1918.	*Inc. or dec.*	2 *months*, 1918. *Inc. or dec.*
IMPORTS.			
Electrical goods ...	55,876	− 51,464	− 96,569
Machinery	1,106,837	+596,612	+ 565,954
EXPORTS.			
Electrical goods ...	156,545	−114,395	− 349,795
Machinery	1,325,331	−482,993	− 1,208,019

Water Power in Co. Donegal.—In the *Irish Builder and Engineer* for March 16th, Mr. Thos. M. Batchen, M.Inst.C.E discusses Ireland's possibilities of power development. Unfortunately, the flow of the great rivers is so variable, that without impounding on a large scale it is impossible to get a very high range of continuous power; nearly all these rivers originate in, and flow through, agricultural or pasture lands, and any water-power scheme involving the flooding of cultivated lands will not be looked upon with sympathy.

The author therefore directs attention to those parts of Ireland where the disabilities attending the great rivers do not obtain, and where smaller installations may be constructed at comparatively little cost per H.P. The Donegal Highlands, Connemara, and Kerry are not unlike the Scottish Highlands in topography, and are subject to an annual rainfall in excess of the figure assumed in Mr. Newlands's paper (abstracted in the Elec. Rev. of February 8th, 1918).

The numerous loughs and well-defined valleys of Donegal lend themselves readily to the cheap impounding, and subsequent regulation of discharge, of this considerable rainfall.

On the Clady River the level of the loughs can be raised 10 ft. in height without injury to cultivated lands or public roads, and a reservoir formed capable of containing, above the draw-off level, 350 million cb. ft. of water. The outflow through a fall of 182 ft. could produce 2,900 H.P. 10 hours a day.

On the Gweedore River, Lough Anure could be raised 25 ft. in level and rendered capable of storing over 380 million cb. ft. of water. The fall obtained is 115 ft., and the estimated power is 1,065 H.P. per 10-hour day. The powers of the Gweedore and Clady river proposals can be generated at the same place, in one power station.

At Owencarrow, Lough Veagh can be converted into a reservoir with a storage capacity of about 420 million cb. ft. Glen Lough can be raised 10 ft., and made capable of storing a further 300 million cb. ft. It is estimated that 1,950 H.P. per 10-hour day can be generated.

Electrical power could be transmitted from several generating stations to electrochemical or other works placed near one of the many Donegal harbours, so that raw material could be brought cheaply into the country, and the manufactured article as cheaply exported. Part of the power could be conveyed to Londonderry for use in the industries of that city.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 31st, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. F. Gaywood.

Monday, March 25th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, March 26th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 27th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 28th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 29th.—Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 10 platform, for work at Esher. Uniform. Marching Order, without rifles. Mid-day and tea rations to be carried.

Saturday, March 30th.—Headquarters closed.

Sunday, March 31st.—Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 10 platform, for work at Esher. Uniform. Marching Order, without rifles. Mid-day rations and tea ditto to be carried.

Special Orders.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The British Engineers' Association.—The sixth annual general meeting of this Association was held in the Central Buildings, Westminster, on Thursday last week; Sir Wilfrid Stokes, K.B.E. (president), in the chair.

There was a large attendance of members from all over the country. The president, in moving the adoption of the report for the year, referred to the growth of the work of the Association, particularly in relation to the obtaining of inquiries from overseas, the issue of the Association's Directories, and the numerous services rendered to individual members. The new Council for the year 1918-19 was declared as follows:—

President.—Colonel O. C. Armstrong, D.S.O.

Vice-Presidents.—Mr. T. O. Callender, Sir John Cowan, Mr. Herbert Marshall, Mr. L. E. Mather, Sir Wilfrid Stokes, K.B.E. (pres. 1915-16-17), Mr. J. E. Thornycroft, Mr. Douglas Vickers (pres. 1912-13-14).

Other Members of the Council:—

Mr. Daniel Adamson	Joseph Adamson & Co., Ltd.
Mr. H. Allcock	W. T. Glover & Co., Ltd.
Sir H. Austin, K.B.E. ..	Austin Motor Co., Ltd.
Mr. S. Brotherhood	Peter Brotherhood, Ltd.
Sir E. G. Burls	Vulcan Foundry, Ltd.
Mr. G. Cradock	George Cradock & Co., Ltd.
Mr. J. E. Darbishire	Hydraulic Engineering Co., Ltd.
Mr. F. C. Else	Wm. Cooke & Co., Ltd. (representing Crane Section).
Mr. C. H. Gilbert	J. Samuel White & Co., Ltd.
Mr. J. Hemming	F. H. Lloyd & Co., Ltd.
Mr. J. H. Humphryes ..	Braithwaite & Co. (representing Steel Structural Section).
Sir J. Hunter, K.B.E. ..	Sir Wm. Arrol & Co., Ltd.
Mr. A. Jacob	British Aluminium Co., Ltd.
Mr. J. R. C. Kearns ..	H. W. Kearns & Co. Ltd.
Mr. C. Lister	R. A. Lister & Co., Ltd.
Mr. B. Longbottom	Electromotors, Ltd.
Mr. H. Lupton	Hathorn, Davey & Co., Ltd.
Mr. C. P. Martin	C. A. Parsons & Co., Ltd.
Mr. A. E. Owen	Rubery, Owen & Co.
Mr. E. W. Petter	Petters, Ltd.
Mr. T. C. Stewart	Stewarts & Lloyds, Ltd.
Mr. J. C. Tennett	Fullerton, Hodgart & Barclay, Ltd.
Mr. N. J. Ward	J. & E. Hall, Ltd. (representing Refrigeration Section).
Mr. J. C. Ward	Edgar Allen & Co., Ltd.
Mr. H. T. Wilkinson	Wardle Engineering Co., Ltd.

Representing other Associations on the Council:—

Mr. Stanley J. Benham ..	Assoc. Master Heating and Domestic Engineers.
Mr. George Clark	Soc. of British Gas Industries.
Mr. Arthur Gamble ..	Midland Forgemasters' Assoc.
Mr. H. C. B. Underdown ..	Assoc. British Motor and Allied Manufrs.
Mr. N. G. Gwynne	Soc. of British Aircraft Constructors.

Dr. Addison (Minister of Reconstruction) attended, and gave an address. Sir Wilfrid Stokes was heartily thanked for his services as president during the past three years.

At a meeting of the new Council, Colonel O. C. Armstrong, chairman of Messrs. Greenwood & Batley, Ltd., of Leeds, was unanimously elected president for the year.

Electrical Power Engineers' Association.—Further propaganda work is being carried out by the Northern Division of the Association, with the ultimate object of getting all power engineers, having the requisite qualifications, to become members. Several Sub-Committees have been formed, one of which is engaged on formulating a scheme for salaries of power station staffs. On Wednesday evening, March 13th, a very successful meeting was held at Blackburn in connection with the E.P.E.A., a large number of staff engineers from Blackburn, Accrington, Darwen, Preston, Rawtenstall, Nelson, and Colne being present. The chair was occupied by Mr. Moxon, of Blackburn, the convener of the meeting, who opened the proceedings with a short announcement of the reasons for calling the meeting. The chairman then introduced Messrs. A. L. Lunn and J. W. Thomas, chairman and secretary respectively of the Northern Division of the E.P.E.A. Mr. Lunn gave an excellent and interesting address on the origin and formation of the E.P.E.A., fully explaining the aims of the Association, and pointed out how important it was for all power engineers to make application for membership of the Association without delay, and, when accepted, to continue as active members. Mr. Thomas followed with a very able and concise statement, describing the lines on which the business of the Association was being conducted from the Chief Executive Committee *via* the three divisions—viz., Northern, Midland, and Southern—which in turn controlled a number of small Branch Committees.

A resolution to the effect that all present were in favour and intended to become members of the E.P.E.A. was put to the meeting, and carried unanimously.

The next general meeting of the Northern Division will be held in Manchester on April 11th.

A meeting of the Council of the London Division of the above Association was held at St. Bride's Institute, Fleet Street, on Wednesday, March 13th. Representatives from over forty London electricity supply undertakings were present. The president, Mr. A. C. Bostel (Croydon), was in the chair. The hon. secretary, Mr. W. A. Jones (Leyton), reported a gratifying continued increase in membership, and stated that the Selection Committee at its last meeting had before it over sixty applications, of which forty were accepted and several deferred for interview of applicants. In common with what exists in the Midland and Northern Divisions, engineers above the grade of engineer-in-charge are now strongly represented in the London Division, and their experience will be useful in the remodelling of the rules, on which work the three Divisions are now engaged.

The Northern Branch, of which Mr. J. W. Thomas, B.Sc., 15, Lotherton Street, Harpurhey, Manchester, is honorary secretary, is at present dealing with the members in Scotland, but it may soon be necessary to arrange for a Scottish Centre. Letters from Mr. Thomas and also the honorary secretary of the Midland Division, Mr. P. J. Burgess, 21, Geraldine Road, South Yardley, Birmingham, were received, and both reported large increases in membership since the annual Conference was held.

The application of the Chief Technical Assistants' Association for affiliation came up for consideration. The E.P.E.A. has already many chief technical assistants within its ranks, and some of the C.T.A.A. members have joined also the E.P.E.A.; the C.T.A.A. has been purely a local technical, and not a protective, Association of Assistant Engineers from municipal supply undertakings in London, and is already affiliated to the London Municipal Chief Engineers' Association—the A.M.E.E. The E.P.E.A. is a National Association with strong legal status; membership is open to all qualified staff engineers in company and municipal electricity supply undertakings throughout the country.

After discussion, it was unanimously decided that there would be no advantage in affiliation while the two Associations maintained their identities. There was a general consensus of opinion that the existence of two organisations with similar objects catering for one type of engineer was prejudicial to the interests of both, and it was only by much closer fusion than affiliation that additional influence, power, and success could be obtained.

Conference of Metropolitan Authorities.—The Conference of local authorities owning electricity undertakings in Greater London has adopted a constitution and rules, in order that the Conference may be placed on a permanent basis. A subscription of £3 3s. per annum is required, to cover the cost of minutes of proceedings, from each authority represented, and four representatives, including the engineer and town clerk, are to be appointed annually in March.

Fuel Economy.—In the House of Commons, on Wednesday last, Sir Albert Stanley said that it was proposed, as regarded Great Britain, that no light should be used for the purpose of illuminating shop windows, and that no food should be cooked or any hot meals served in any hotel, club, or restaurant between 9.30 at night and 5 o'clock the following morning. All lights in the dining rooms of these places must be extinguished between 10 o'clock at night and 5 o'clock the next morning. It was also proposed that no performance in any theatre or other public place of amusement should be conducted after 10.30 at night, or be re-opened before 1 o'clock the next day, and that all lights must be out between these hours with the exception of those actually required for the use of the employés. It is understood that at first the proposals will be applied only to the southern part of England, including London and the Home Counties.

The object of the scheme is to secure economy in the use of fuel, power, and labour, besides relieving the underground railway, tramway, and motor omnibus services. The reduction of the suburban train services at night, as well as the early and late tramway services, is, we understand, under consideration, and considerable curtailments are to be made. Strict economy, not only in the use of coal, but also in gas and electricity for lighting and other purposes, is necessary. Gas and electricity supplies will be reduced by one-sixth. As to coal, it is proposed to issue a new scale of rations which will continue for a year from April 1st next, and a 25 per cent. reduction will probably be enforced. Coal rationing will be applied to the whole country.

It is not merely that the carriage of coal to London makes serious inroads into a transport system which is becoming more congested every day, but there is pressing need of economy of man power and in the actual work at the pits. In 12 months the coal mines of the country need about 40 million cb. ft. of timber, most of which has to be cut and sawn in this country. The coal question carries others with it, not the least difficult of which is that of transport.

It is stated that Mr. Guy Calthorp, the Coal Controller, has a proposal under consideration to make the whole country south of Leeds dependent for its coal supplies upon pits in its own area, excluding South Wales.

Exaggerated figures have been given, no doubt, in connection with these proposals; here we ought to consider ourselves lucky in having as much coal as we have had all through the war. Great Britain is the only country in Europe in which a fuel crisis does not exist. According to an expert, says the *Evening News*, "London is the greatest manufacturing centre in this country, and but for the fact that electrical power has made such headway in factories we should have had a coal crisis long ago." The Board of Trade is helping manufacturers to rearrange their plant so as to enable them to take electric power from the big concerns. Through the Coal Controller steps will be taken, after consultation with the Ministry of Munitions, to curtail the public services which entail coal consumption, especially the early and late tramway services. It may become necessary for electric lighting undertakings to disconnect non-essential consumers, in order that sufficient power may be provided for industrial purposes.

The Marconi Case.—In the House of Commons, on Tuesday last, Sir Chas. Hobhouse made a statement in which he categorically denied the allegation put forward by counsel for the Marconi Co. in the action reported on another page, to the effect that he had endeavoured to induce the Telefunken Co. to come to this country and compete with the Marconi Co. He had visited Nauen, and lunched with the directors of the Telefunken Co., accompanied by Sir Henry Norman as interpreter, but did not mention the subject of competition with Marconi, then or at any time. He also declared that Mr. Godfrey Isaacs's account of the interviews with him was a pure fabrication, and that he had never acquiesced in the statement that he had given the Telefunken Co. encouragement.

Sir Henry Norman also made a statement denying that he made an offer of any kind to the Telefunken Co., or to anybody else, and pointing out that he had always maintained that the wireless chain should be erected not by any company whatever, but by the State.

On the motion for the adjournment, Sir F. E. Smith stated with regard to the contract that the view which he took was that the Post Office had, without legal warrant or justification, broken a contract, and that they were liable in damages for that breach, and he gave that clear advice. When the negotiations with the company broke down, he advised the Government that none of the legal contentions which had been raised for three years could be successfully sustained, and at an early stage of the proceedings he discovered that the Judge had formed views which agreed precisely with his own. He took the responsibility of saying that he would not allow the case to go on, the moment that the public had been informed of the circumstances.

Mr. Herbert Samuel said that he regarded the contract as a remarkably good bargain for the State. There was an understanding with reference to the second three stations that, save in very exceptional circumstances, if those stations were erected the work should be brought into the general contract with the Marconi Co.—*The Times*.

In yesterday's papers a letter from Mr. Godfrey Isaacs to Sir Chas. Hobhouse was published, in which the former challenged the latter to repeat his statement in public, in order that Mr. Isaacs might be enabled to take proceedings against him. Sir Chas. replied that he had stated the facts fully in the House of Commons, and he left it to the public to draw their own inference.

The Industrial Reconstruction Council.—This Council is holding the second of its series of provincial meetings at the Assembly Hall, Edinburgh, on Wednesday, April 3rd, at 8 p.m. The Lord Provost will preside, and Dr. Addison, Minister of Reconstruction, will be the principal speaker.

An Automatically Operated Synchronising Station.—The Iowa Railway & Light Co., of Cedar Rapids, has two 13,200-volt transmission lines which it is desirable to operate in parallel, yet which join each other at a point where it is frequently desirable to open the circuit. Moreover, it is not desirable to interrupt service on either line to bring about the paralleling of the two sections after the line has been opened. A sub-station simply for the purpose of connecting the lines together at this point did not seem to be justified. To meet this condition, therefore, the company's engineers have installed an automatic synchronising station and a set of watt-hour meters, equipped with ratchets, to record the interchange of power between the two sections of the system.

The apparatus consists of two sets of 1-KW. transformers, two sets of relays, an automatic synchronising device, a 1-KW. motor-generator set, an oil circuit breaker, and a few additional relays. The two sets of relays are connected across the phases of the secondary sides of the transformers, which are in turn connected in the 13,200-volt circuits. The contacts on these relays are in series, therefore the closing of all relays is accomplished, when all phases are energised. When all of these series contacts are closed the small motor-generator set is started. It supplies energy through its direct-current unit, when it comes up to full voltage, to close a direct-current relay. This in turn permits alternating-current energy to flow to the synchroscope. The synchroscope, manufactured by the Westinghouse Electric & Manufacturing Co., consists essentially of two solenoids acting on cores hung on the opposite ends of a rocker arm. The solenoids are connected so that the right-hand end of the rocker is at the extreme lower end of the stroke when the electromotive forces to be synchronised have no phase difference and is at the upper end of the stroke when the phases are in opposition. This causes the rocker arm to oscillate up and down. When the right-hand end of the rocker arm approaches the lower end of its motion with less than a predetermined speed a contact closes the circuit of an auxiliary relay, which in turn closes the circuit operating the closing coil of the main oil switch. The closing of the contact occurs before synchronism by a predetermined length of time sufficient to permit the main switch to complete the circuit exactly at the point of synchronism. The synchroniser does not make contact at all unless the difference in speed of the two machines at the different ends of the line is less than a predetermined amount.

This apparatus, together with the metering equipment, takes care of itself entirely, except for a visit from an attendant about once every three months. The installation was worked out for the Iowa Railway and Light Co. by John M. Drabelle, the company's electrical engineer.

Pulverised Coal.—In view of the present coal situation, the results secured in a recent 24-hour test of a 150-H.P. Brownell horizontal return tubular boiler at the demonstrating plant of the Powdered Coal Engineering & Equipment Co., Chicago, when fired with powdered coal, are of interest to every coal user.

The boiler furnace was served by two 12-in. Prüden coal carburettors. The coal burned was a high ash (22.09 per cent.), La Salle County, Illinois, screenings with a heating value of 10,158 B.TH.U. on a dry basis. The coal was dried and pulverised in the demonstration plant of the company, this coal preparation unit having a capacity of 60 tons of pulverised fuel per day. As burned under the boiler, the coal dust had a moisture content of 2.94 per cent. A screening test showed that 98.8 per cent. passed through a 100-mesh screen, and 90.5 per cent. through a 200-mesh screen.

The proximate and ultimate analysis of the coal is given in Table I:—

TABLE I.—*Proximate Analysis.*

	Dry, per cent.	As burned, per cent.
Moisture	—	2.94
Volatile matter	37.61	36.49
Fixed carbon	36.81	35.42
Sulphur	3.79	3.71
Ash	22.09	21.44
	100.00	100.00

Ultimate Analysis.

	Dry, per cent.
Carbon	60.86
Hydrogen	4.32
Nitrogen	0.99
Oxygen	7.95
Sulphur	3.79
Ash	22.09
	100.00

In Table II are given some of the results and data of the test:—

TABLE II.—*Results of Evaporative Test.*

Water heating surface: 1,504 sq. ft.
Steam pressure by gauge: 135.1 lb.
Temperature of feed water entering boiler: 145 deg. F.
Temperature of escaping gases leaving boiler: 609.8 deg. F.
Force of draught in fire box: 0.15 in.
Percentage of moisture in steam: 0.95 per cent.
Dry coal consumed per hour: 735.7 lb.
Equivalent evaporation from and at 212 deg. F.: 5,572 lb. per hour.
Equivalent evaporation from and at 212 deg. F. per lb. of dry coal: 7.59 lb.
Equivalent evaporation from and at 212 deg. F. per lb. of combustible: 9.73 lb.
Calorific value of 1 lb. of dry coal: 10,158.
Calorific value of 1 lb. of combustible: 13,039.
Efficiency of boiler, furnace, and grate: 72.8 per cent.
Efficiency of boiler and furnace: 72.5 per cent.

The CO_2 content was much higher than average or usual standard practice. The conditions under which the test was made were unfavourable from the standpoint of thermal efficiency, the average temperature of the air fed with the powdered coal being approximately 4 deg. F.

Bituminous coal, of 15 per cent. ash, under ordinary conditions of grate firing will usually be found to produce an ash which contains from 16 to 18 per cent. combustible. The ash and slag produced in the test given above contained only a trace of combustible, less than 0.1 per cent. "It is evident, then, that the burning of powdered coal by the carburisation process represents a saving in this instance of 3.74 per cent. of the heating value of the coal, due to the fact that the coal is completely burned.

The results reported in this test do not represent unusual operating conditions, necessitating the supervision of trained technical men and unusual care in firing. They represent what may be obtained day in and day out, without extra precautions, and without skilled engineers.—*Electrical Review* (U.S.A.).

Tar-Oil Experiments.—In a report presented to the Dundalk Urban Council, Mr. Spalding, the Council's electrical engineer, referring to his experiments on the use of a lighter gravity tar oil, stated that although the oil possessed certain advantages on a heat energy basis, the large excess of naphthalene present in the lighter oil created considerable difficulties in regard to handling and storage. In cold-weather the oil in the storage-tank and in the supply pipes became quite solid owing to the accumulation of naphthalene crystals. Trouble also arose from a similar cause with the valves of the tar-oil pumps on the various engines. It would be necessary to keep the oil stored in yard tanks at not less than 60° F. at all times, to prevent crystallisation troubles, and to effect that he was fitting over a 10-ton tank one electric heaters of a special design. When running on American crude oil, it was found necessary to clean the engine pistons only once every 12 months, but it would now appear to be advisable, with tar-oil as a fuel, to repeat this operation once every six months.

Electrical Trades Benevolent Institution: the Cardiff Concert.—The proceeds of the concert organised at Cardiff in aid of the funds of this Institution have been further increased by a donation of 25 guineas from the General Electric Co., Ltd. This brings the total amount by which the Institution has benefited by this concert to £49 5s.

Inductive Interference with Telegraph and Telephone Lines.—The Joint Committee on Inductive Interference, organised in December, 1912, by the California Railroad Commission, and authorised to conduct an investigation of the problem of inductive interference with communication circuits by parallel power circuits, has completed its work, after continuously investigating this subject for over five years, at a cost of over £20,000, borne jointly by the interested railroad, power, and communication companies and the California Railroad Commission. The investigation has obtained results of great consequence to railway, power, telephone and telegraph companies, and to manufacturers of electrical apparatus, as well as to public authorities which exercise jurisdiction over them. Some of the general conclusions have been published by the technical Press at different times during the progress of the investigation, but practically none of the technical data have thus far been made generally available. From time to time technical reports have been prepared which give the data obtained and the conclusions arrived at, and 30 of these reports have been selected for publication, together with final recommendations for rules for the prevention and mitigation of inductive interference. The book will have a complete index, and will contain approximately 1,000 pages, with over 400 drawings and 30 photographs. The publication is contingent upon obtaining, in advance, a sufficient number of subscriptions to cover the actual cost of printing and binding, at a price not to exceed $10.00 per set. Engineers interested in this problem are invited to communicate at once with the Commission, as the number of copies printed will be limited, and only those subscribing in advance can be assured of receiving copies. Inquiries should be addressed to the chief engineer of the Commission, Mr. Richard Sachse, 833, Market Street, San Francisco, Cal.

British Oil.—An offer by Lord Cowdray to spend, if required, £500,000 in boring for oil in this country has been taken up by the Government. Arrangements have been made for trial bores to be sunk by Lord Cowdray's firm in a locality where petroleum geologists expect to find oil. Mr. Bonar Law stated in the House of Commons that a satisfactory agreement had been come to with a firm which was to undertake the work.—*Daily Mail.*

Wet Condensers for High-pressure Service.— For certain investigations requiring the continuous use of a fat spark from a closed-circuit transformer of 1 kilowatt, at 11,000 volts, the glass plate condensers usually employed broke down owing to heating. After trying one-litre beakers covered with tinfoil, which proved tedious and costly to make, similar beakers (of heat-resisting glass) were partly filled with a nearly saturated solution of common salt, and partly immersed in a similar solution contained in earthenware vessels. The surface of the liquid was covered with a layer of oil 5 cm. deep to eliminate sparking. The mean capacity of each jar containing four beakers was 0·0092 mfd., and the condensers gave perfect satisfaction under severe use for many months. The cost was about the same as that of glass plate condensers. Sets made up with mercury instead of salt solution had a capacity about 10 per cent. higher, when measured at a low constant pressure, but at the high and discontinuous pressures employed to produce the spark, the capacity of the mercury-filled condensers was judged by the fatness of the spark to be three or four times as great as that of the condensers with salt solution.—E. KARRER and H. S. NEWCOMER, in *Science.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—MR. L. W. WOODMAN, who resigned his position in Dover as borough electrical engineer, in order to take up an appointment on 20th inst. as electrical engineer to the National Smelting Co., Avonmouth, desires manufacturers to forward copies of their catalogues and price lists. The duties of Mr. Woodman's appointment will probably not be confined to the Avonmouth works, but will, in the near future, include the supervision of the electrification of other industrial undertakings.

Swansea Corporation Electricity Committee has increased the salary of MR. REES, the deputy borough electrical engineer, to £300, without bonus.

Fulham E.C. recommends that a gratuity of £50 be paid to MR. A. MURDOCH, station superintendent at the borough electricity works, for extra services rendered by him in his own time, during the past 12 months, in connection with the extension of the boiler plant.

Blackburn Electricity Committee has decided to grant MR. WHEELWRIGHT (electrical engineer) an honorarium of £500 for the special work executed in his department since the war began.

MR. W. FENNELL, resident engineer at St. Albans for the North

Metropolitan Electrical Power Supply Co., and previously borough electrical engineer at Wednesbury, has been appointed engineer and secretary of the Northwich Electric Supply Co., Ltd., in succession to the late Mr. W. Boyd.

The Dundalk U.D.C. has increased the salary of Mr. P. A. Spalding, electrical engineer and manager, from £300 to £400 per annum.

Accrington General Purposes Committee recommends an increase of £50 a year to the borough tramways manager, Mr. H. Pilling. It also recommends war bonuses ranging from £35 to £15 a year to officials and staffs, in addition to a previous bonus of £15 a year.

General.—Mr. M. W. Clarke, who has held the post of technical assistant and head of the testing department in the electrical department of Messrs. Cammell, Laird & Co., Ltd., Sheffield, for the past five years, is shortly leaving to take up an appointment as chief electrical engineer to Messrs. Spencer & Co., Ltd., electric conveyor and elevator builders, Melksham, Wilts.

On Friday last the heads of the wholesale and retail electrical firms in Bristol entertained Mr. Arthur H. Dowson, of Veritys, Ltd., at Stuckey's Restaurant, Wine Street, at a farewell dinner, and presented him with a 52-oz. silver tray, suitably inscribed. Mr. A. C. Wiley (the chairman) and Mr. E. Fifield (vice-chairman) referred to the esteem in which Mr. Dowson was held in the district, and expressed the good wishes of the company on his taking up his new position with the Imperial Tobacco Co., Ltd.

By deed poll, Mr. William Beisiegel, electrical engineer, of 80, Montholme Road, Clapham Common, has changed his name to William Simmonds.

Captain H. W. Grant, C.B., R.N., has been appointed joint managing director of the Eastern Telegraph Co., Ltd.

At St. Mary's Church, Dunsford, on March 9th, the marriage took place of Captain Reginald F. Long, M.C., Royal Artillery Special Reserve, A.M.I.E.E., and Miss Ethel Gertrude Downer, of Godalming.

Roll of Honour.—Sergeant Wm. Brayshaw, K.O. Rifles, reported seriously wounded, was employed with Mr. Horace Green, electrical engineer, Cononley, Yorkshire.

Private F. B. Lane, West Riding Regiment, killed in action, was with Messrs. Bullers, Ltd., of Hanley.

Lieut. J. R. Beckton, R.E., killed in action, was, prior to the war, a draughtsman with Messrs. Crompton & Co., Chelmsford.

Captain E. Mannock, R.E., attached to the R.F.C., formerly of the staff of the National Telephone Co. at Wellingborough, has gained a bar to his Military Cross for destroying several German aircraft in aerial fights.

Obituary.—Mr. George Herbert Carter, late electrical engineer to the Heckmondwike District Council, died on March 13th, at the age of 57. He had been in failing health for some time.

Will.—The late Mr. G. Beith, electrical engineer, of Pontypridd, left £24,865 gross and £24,352 net personalty.

NEW COMPANIES REGISTERED.

Boving Engineering Works, Ltd. (149,748).—Private company. Registered March 1st. Capital, £70,000 in £1 shares (30,000 pref. and 40,000 ord.). To take over the business of constructional engineers, iron-founders, and boilermakers carried on by Hartley, Causton & Richmond, Ltd., and to enter into agreements with (1) Boving & Co., Ltd., and (2) Electro Metals, Ltd., and Boving & Co., Ltd. The subscribers (each with one preference share) are:—S. J. Collins, 39, Chester Road, Lower Edmonton, N., accountant; J. A. Hartigan, 79, Wernbrook Street, S.E. 18, departmental engineer. The first directors are:—J. O. Boving, S. D. Lane, C. T. Colpitts, A. Eving, and F. Keer. Qualification, £100. Remuneration, £100 each per annum, and a percentage of the profits after 7 per cent. is paid on the ordinary shares. Registered office: Imperial Buildings, 56, Kingsway, W.C. 2.

Electric Deposits, Ltd. (10,017).—Private company. Registered March 7th. Capital, £5,000 in £1 shares. To carry on the business as indicated by the title, and that of engineers, machine and tool makers, &c. The subscribers (each with one share) are:—John T. Ballantine, 39, Bath Street, Glasgow; Hugh McKellar, 36, Bath Street, Glasgow. The first directors are:—A. Ness, D. O. Mitchell, and J. F. Ballantine. Registered office: 250, Great Western Road, Glasgow.

Fricker's Metal Co., Ltd. (149,885).—Registered March 15th. Capital, £80,000 in £1 shares (21,500 pref.). To take over the business of manufacturers of zinc oxide carried on by a company of the same name (incorporated in 1910) at Langley Metal Works, Luton; also to carry on the business of electrical and mechanical engineers, &c. The subscribers (each with 50 ord. shares) are:—E. H. Wood, Campana, Sidcup, chairman of a company; G. C. Fricker, The Limes, Harpenden, engineer; F. Miller, 4, Redington Road, N.W. 3, electrical engineer; D. Parry, 1, Albert Drive, Glasgow, manufacturing chemist; C. W. King, High Street, March, Cambs., solicitor; H. E. Carey, 53, Cardiff Road, Luton, company secretary; S. Young, Cecil House, Holborn Viaduct, E.C., company director. Minimum cash subscription, 10 per cent. of any shares offered to the public. The first directors are:—G. C. Fricker, F. Miller, and J. A. Wood. Registered office: —Langley Metal Works, Langley Street, Luton, Beds.

Motive Power Improvement Co., Ltd. (149,791).—Private company. Registered March 6th. Capital, £6,850 in £1 shares (3,500 pref.). Mechanical and electrical engineers, and manufacturers of machinery of all kinds, marine engineers, gas makers, shipowners, shipbuilders, &c. The subscribers (each with one ord share) are:—F. H. Wyvill, 1, Fairfield Road, Crouch End, N., law clerk; R. Spence, 77, Drakefield Road, Tooting, S.C., accountant's clerk. The first directors are to be appointed by the subscribers. Registered office:—Norwich House, Holborn, W.C.

Calgray & Co., Ltd. (149,849).—Private company. Registered March 13th. Capital, £6,000 in £1 shares. To take over the business of manufacturers of electric wires, &c., carried on at 326, Goswell Road, E.C., as Calgray & Co. The subscribers (each with one share) are:—E. Calvert, Quennington, Duke's Avenue, Finchley, N., engineer; T. J. Grainger, 8, Ashgrove Terrace, Gateshead-on-Tyne, merchant. The first directors are:—E. Calvert and T. J. Grainger. Qualification, £250. Registered office:—326, Goswell Road, E.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London United Tramways, Ltd.—Particulars of £33,000 second and £68,000 third debentures, created April 3rd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount of each series issued on February 27th, 1918. Property charged: (a) The company's undertaking and property, except Hammersmith tramways, Chiswick property, and lands acquired for road improvements, and (b) uncalled and unpaid capital.

Cutting Bros., Ltd.—Particulars of £15,000 debentures created February 14th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Particulars of £17,500 debentures created December 20th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Imperial United Lamp Co., Ltd.—Particulars of £7,000 debentures created January 19th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £6,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Aldeburgh Electric Supply Co., Ltd.—Debenture dated February 9th, 1918, to secure all moneys due or to become due (not exceeding £2,500) to Barclays Bank, Ltd., charged on the company's undertaking, real and personal estate, patent assets, and effects, including any issued or uncalled capital (but not unissued capital and calls already in arrears).

British Electrolytic Zinc Co. (Isherwood Process), Ltd.—Charge dated February 21, 1918, to secure £2,000 and further advances, not exceeding £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. E. Heath, 3-4, Royal Exchange Buildings, E.C. 4.

Allen, West & Co., Ltd.—Particulars of £55,000 debentures created December 3rd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital.

Capital, £30,000 in £1 shares. Return dated December 17th, 1917. 28,472 shares issued and fully paid. Mortgages and charges: £20,000.

British Battery Co., Ltd. (137,905).—Capital, £1,000 in £1 shares (800 pref.). Return dated January 3rd, 1918. 800 pref. and 199 ord. shares taken up; £999 paid. Mortgages and charges: £1,300.

Alliance Electrical Stores, Ltd. (111,804).—Capital, £25,000 in 47,500 pref. ord. shares of 10s. each, and 1,250 def. ord. shares of £1 each. Return dated February 22nd, 1918. All shares issued. £3 10s. paid on seven pref. ord.; £24,996 10s. considered as paid on the remainder. Mortgages and charges: Nil.

David Bridge & Co., Ltd. (106,016).—Capital, £25,000 in £1 shares (16,000 pref. and 9,000 ord.). 15,830 pref. and 4,170 ord. shares taken up to February 26th, 1918; £20,000 considered as paid. Mortgages and charges: £8,800; also secured by debenture trust deed, charge on certain land, by way of guarantee of perpetual yearly rent, charge of £54 until buildings are erected on other lands.

CITY NOTES.

Charing Cross, West End and City Electricity Supply Co., Ltd.

The report, to which we briefly referred last week, gives the following results for 1917:—

West End Undertaking.—Gross earnings £165,136, against £150,473 in 1916; expenses, excluding depreciation, £103,268, against £78,831 in 1916; net earnings £61,869, against £71,641. Including £15,090 brought forward, and other items £5,156, less £17,829 for debenture interest and £22,000 put to depreciation, there is a net revenue balance of £42,285. The preference dividend, and 4 per cent. on the ordinary shares are paid, leaving £8,285 to carry forward. The connections are 740,989 (30 watts), consisting of 462,376 lighting, 52,912 heating, and 225,701 motive power. Units generated 3,042,308, bought 14,939,928. Units sold 12,389,551. 303 public lamps used 379,025.

City Undertaking.—Gross earnings £212,542, against £176,464 for 1916; expenses £147,153, against £110,909; net earnings £65,388, against £65,555. Including £18,000 brought forward, and deducting £29,131 for debenture, loan, and other interest, the balance is £54,257. The preference dividend absorbs £18,000, leaving £36,257, of which £18,257 is put to general reserve (income) account, and £18,000 is to be carried forward. The connections are 789,597 (30 watts), consisting of 324,122 lighting, 87,656 heating, and 377,819 motive power. Units generated 39,478,730, sold 32,209,425; used on works and in transmission and distribution 7,269,305.

Davis and Timmins, Ltd.

Sir Henry Mance, presiding at the annual meeting, after going through the accounts, said that the net profit was a little less than for 1916, owing to higher prices of metal and heavy cost of labour. With regard to the future, he must again warn them that the results of the last year or two must be considered entirely exceptional. It would be impossible for them to continue for an indefinite

period, but he had every confidence that when normal times and normal business returned the dividends would be quite as good as immediately before the war.

Mr. G. E. Davis, the managing director, addressed the meeting, giving information as to the state of the works, as to the conditions under which the results were obtained, and a forecast of the future as it appeared to him. In their case he did not think they need anticipate immediate and sudden changes on the cessation of hostilities. Their war work did not differ materially from their peace-time work. Though their manufactures were certainly varied in pattern, shape, size, &c., and numbered in thousands at all times, their general nature was always much about the same. When Peace came they ought to be in as good a position as before the war. They might have to meet more competition, but that would only spur them on to further efforts. Much would have to be done all over again to renew contracts and relations with their suppliers of raw material. None of their supplies ever came from Germany, nor ever would so long as he had a voice in the matter.

South London Electric Supply Corpn., Ltd.

In the course of his speech at the annual meeting, the Chairman said that the total receipts had increased by £7,619, or nearly 13 per cent., but the expenditure had risen by £5,068, or 16.5 per cent. Coal increased by £4,297. The price of coal delivered on to their sidings was about double that ruling before the war, and the quality was very inferior, the ash contents being exceedingly high, and involving increased costs for labour in handling. The capital expended during the year was £13,552, chiefly for new mains and conduits, it having been necessary, owing to the very heavily loaded condition of the feeders and distributors in the northern area to augment the supply there. The opportunity was accordingly taken, when the County of London Co. were laying their conduits for the bulk-supply cables, to provide additional conduits for their own purposes, and to draw in a new feeder cable of 2,000-kw. capacity for the purpose of relieving the existing mains and providing additional capacity to meet the demand as it occurred. This feeder cable would terminate in a new sub-station, in the vicinity of the principal power load, from which all demands for supply for some time to come could be adequately satisfied. Owing to great difficulties encountered in obtaining materials and switchgear, and labour, the bulk supply from the County of London Electric Supply Co. had not yet been made available, but, subject to the delivery, now much overdue, of certain parts in connection with the transforming apparatus, this supply should be available very shortly. The main supply cable was completed, and ready to deliver current immediately these parts were forthcoming. Units sold showed an increase of 12.7 per cent., principally for power supply to munition factories, but the supply for heating purposes had also materially improved, due to the increasing popularity of electric heaters. It was not unlikely that proposals would come forward for the erection of super-power stations, supplying large areas in place of small stations. There was much to be said on both sides. One of the points which would have to be maintained was that London had very special circumstances and conditions of its own, and should be treated as a separate self-contained area. The recent compulsory addition of 12½ per cent. to the gross earnings of their employés imposed a further serious burden on their expenditure, and their war percentage on accounts for electricity supplied had consequently had to be increased since the commencement of the year.

Bruce Peebles & Co., Ltd.

Mr. Andrews, in addressing the annual meeting, stated that the turnover had again been increased during 1917. The value of the output was more than in any previous year, and the volume of orders for starting 1918 was greater than at any former period. With reference to their often expressed desire to add to their electrical manufacturing some other special branches of engineering work, they had now acquired the designs, patterns, and connections of a sound hydraulic and general engineering business. Considerable orders had been obtained already, and they had every expectation that the new department would not only satisfactorily enlarge their operations and add to their general stability, but would increase their business connections for electrical machinery. Even before the war they found themselves considerably hampered for want of greater facilities for building the heavier types of electrical machinery. They did their best by means of temporary expedients. The trend of the electrical engineering business was an increasing demand for larger plant, and if they were to keep their position as the largest manufacturers of electrical machinery in Scotland, and one of the leading manufacturers in Great Britain, it was essential that they should have shops suitably and adequately equipped for dealing with this heavier electrical plant, and with the hydraulic engineering work to which he had referred. Apart from this, however, it was very necessary to have additional space, so as to relieve the great congestion in their older main works, and to cope with national requirements. They had, therefore, obtained permission from the Government, and placed contracts for the building, crane, and various heavy tools, &c.; before long they hoped to have that extension in full swing. The year had been an anxious and trying period, and he was pleased to express their hearty appreciation of the work of the general manager, Mr. Bunting, and the heads of the various departments. The profit and loss account showed a profit from manufacturing and trading amounting to £23,616, as compared with £24,468 last year, and £15,945 the year before. The total gross profit was £26,247, as compared with £26,248 for 1916. When the present company was formed they had a heavy and uphill task in order to re-establish their position in the industrial world. They had a very small and totally inadequate working capital, and, to make matters more difficult, the electrical industry was at that time passing through a period of acute depression and insane competition. By steady work and persistent effort, however, they gradually and surely placed their business on a thoroughly sound foundation, and profits were made which eventually wiped out the losses of the earlier years, but the war caught them at a most unfortunate moment, as the years on which their standard of profit had been based were some of their worst, and therefore war taxation now swept away the bulk of their profit, and only left them comparatively small residue. In practice these taxes had worked out at even a higher figure than was anticipated. Their case was an exceptional one. It inflicted hardships on the shareholders, and it seemed a pity that some slight measure of consideration could not be accorded to a company in their peculiar position, especially having regard to the fact that their normal business had necessarily been sacrificed to meet the needs and interests of the country. In regard to the reorganisation of the capital account, both the 5 per cent. mortgage debentures and the 6 per cent. unsecured debentures fell due for repayment on July 1st, 1918. The company had regularly paid the interest on the mortgage debentures, and had redeemed £25,150 of these, thus reducing the total issue of £75,000 to £49,850. With regard to the unsecured debentures, they had from time to time redeemed by purchase £15,375 out of the total issue of £66,447, thus leaving on December 31st, 1917, £51,072 outstanding. In view of the great difficulties of their position in the early days of the present company, they could claim to have done fairly well in thus reducing the total debenture debt by over £40,000, but it was obviously not feasible at the present time to pay off the remainder of these debentures and the accrued interest. The directors, after long and careful consideration and after consultation with some of the principal debenture and shareholders, formulated a scheme which was considered fair and equitable. The proposals were placed before both classes of debenture-holders and the shareholders in February, when all the resolutions were passed by large majorities. The scheme of arrangement was now before the Court for the requisite confirmation and sanction.

British L.M. Ericsson Manfg. Co., Ltd.

Mr. W. M. Crowe, presiding at the annual meeting, stated that the net profits £72,512, were the largest in the history of the company. Their position was growing stronger every year. The prospects for the future were bright. A large canteen for the workpeople was in course of erection. The labour question had been difficult, but they had not had much of the extreme trouble experienced by some firms. The labour question was, however, still very unsettled, so that at any moment there might be an unheaval. In common with a number of other companies they had taken up a new industry, which, if liberally and fairly treated by the Government, ought to bring much business to the country, but if not so treated would cause an immense loss of capital. To them it was only a side-line of their business proper, but they had taken it up seriously, and intended going on with it. They had spent a good deal of money in developing that industry, but others had spent a great deal more, and at the special request of the Government, for the benefit of the country in its present dilemma, and for its future prosperity. They did not claim a free hand to make the public pay through the nose for these goods, but they did claim a fair price, and sufficient protection for the industry. The speaker put forward a plea for a large measure of Protection for industry when the time came. He hoped that there might be no uncertain sound on the part of the Government after the war. The Government, through the High Court, appeared to be more concerned about protecting the patents of the enemy than the more important question of allowing and encouraging progressive firms to develop new industries. He wondered what protection the German Government would give to a British patent if that patent in any way stood in the way of its industries. After our experience of German penetration and brutality, we should have no finer feelings as to their patents or other interests.

Eastern Telegraph Co., Ltd.—Owing to the continued delays in obtaining the necessary returns from foreign stations and administrations it will be impossible to present the accounts for 1917 during the month of May, when it has been usual to hold the annual general meeting. Estimates based on data received shows that the net earnings were sufficient for the usual distribution of profits. An additional payment is to be made on the ordinary stock equal to a dividend of 1¼ per cent. and bonus of 2 per cent., making 8 per cent., free of income-tax, for the year.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The remarks used above in the case of the Eastern Co.

applies in this case also. A fourth dividend of 3s. per share, together with a bonus of 4s. per share, is to be paid, making a total distribution for 1917 of 8 per cent., free of income-tax.

Prospectus.—*Tees Power Co. Ltd.*—Prospectuses are a rarity in these days of war, but special circumstances have induced the Treasury to authorise new issues occasionally. It has decided to raise no objection to the issue of this company "on condition that any generating station constructed by it shall for the purposes of any scheme that may result from the recommendations of the Electric Power Supply Committee be treated as though it had been constructed under the provisions of a Special Act or Provisional Order." The company is offering until March 23rd £600,000 6 per cent. first mortgage debentures, principal, interest, and sinking fund being payable by the Newcastle-upon-Tyne Electric Supply Co., Ltd.

The debentures will be secured by a specific first mortgage upon freehold land, approximately 35 acres in extent, which has been acquired by the company, situate on the north bank of the River Tees, near Middlesbrough, having a river frontage of over 1,250 ft., with convenient access by road and railway; and upon the power station buildings, fixed plant, and machinery to be erected thereon, and the adjoining foreshore and river bed; and by a floating charge on the other assets of the company, without power to charge in priority to or *pari passu* with the debentures; and by the assignment to the trustee of the benefit of an indenture between the company and the Newcastle-upon-Tyne Electric Supply Co., Ltd., whereby the latter company, in consideration of the grant to it by the company of the right to use and occupy the power station and land, will covenant unconditionally to pay to the company periodically the amounts required to pay the interest on the debentures for the time being outstanding and the sinking fund above-mentioned and to redeem the outstanding debentures in the event of the security becoming enforceable under the terms of the Trust Deed.

Newcastle & District Electric Lighting Co., Ltd.—At the annual meeting, Dr. J. B. Simpson reminded the shareholders that the trust deed provided that the whole of the second debentures should be redeemed in 30 years by the operation of a cumulative sinking fund, a certain sum having to be applied out of the profits each year for this purpose. The amount at the credit of this fund, £13,237, was equivalent to further provision for depreciation and obsolescence, in addition to the £50,000 already mentioned. The total working costs showed an increase of £5,406, or 9½ per cent., and receipts for energy an increase of £5,463, or 5½ per cent. Units sold increased by 4 per cent. In consequence of increased costs, the directors had found it necessary to raise the price of electrical energy as from April 1st. The directors did not at present feel justified in recommending more than 2½ per cent. dividend, but they hoped in the near future to be in a position to do so. In regard to the Coal Conservation Sub-Committee's report as to an extended use of electrical energy, if the recommendations of the Committee were accepted, legislation would be necessary, but this was likely to be beneficial, not only to the public, but to the supply authorities.

Fraser & Chalmers, Ltd.—With further reference to our statement of several weeks ago respecting the purchase of the business of Fraser & Chalmers by the G.E.C., it is now announced by the directors of the former company that negotiations have been practically completed for the sale of the Erith works to the General Electric Co., including the goodwill of the manufacturing business and the construction of turbines, dry gas cleaning plant, and plant for the storage and handling of coal and ores. The company will retain the goodwill of its business in mining, milling, and metallurgical machinery, with manufacturing rights in respect thereof, and also its large merchanting business in South Africa and elsewhere, and its agencies for British and American manufacturers. The exact amount of the consideration for the sale, which is payable wholly in cash, depends upon inventories of stocks, stores, and work in progress. The purchasers will complete for the account of the company all orders now in hand for mining machinery, and Fraser & Chalmers is also negotiating for the execution of new orders for mining machinery on terms to be agreed.

Neuhausen Aluminium Co.—The net profits for 1917 of the Aluminium Industrie A.G., of Neuhausen, are reported to amount to £792,000, as compared with £682,000 in 1916, which, in turn, showed an increase of about 100 per cent. over the preceding year. A sum of £200,000 for hydraulic works and £160,000 for depreciation has been set aside previous to striking the net profits. The rate of dividend, which is maintained at 20 per cent., will be paid this time on the fully-paid share capital of £1,400,000, whereas the capital participating last year was £1,010,000. In the meantime the capital has been raised to £1,400,000 by an appropriation from the fund for the payment in full of the share capital, which was formed by allocations from the net profits. During the course of the war a total of £560,000 has been drawn from the fund for this purpose. It is now proposed to increase the capital by £280,000 by the presentation of new shares to the existing shareholders in the ratio of one new share to five old shares, thus raising to £840,000 the total amount gratuitously placed at their disposal since 1914.

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1917, £642,783; working and general expenses and renewals, £530,176. Net revenue, including balance forward, £122,242. After paying debenture interest, preference dividend, and two half-yearly dividends on the ordinary (at the rate of 5 per cent. per annum, subject to tax, and 7½ per cent. per annum, free of tax), £30,000 is put to reserve for contingencies and renewals, and £18,152 is to be carried forward. The receipts of the tramways department increased by £90,737, and those of the carriage department by £52,987. Passengers carried increased by 3,353,433 to 63,981,775. The period within which the Bristol Corporation has option to purchase the tramways has been extended to October 31st, 1918.

British Insulated & Helsby Cables, Ltd.—The profit for 1917, after providing for estimated liability for excess profits duties to date, amounts to £363,059, plus £163,647 brought forward, making £526,707. This is disposed of as follows:—Directors' and debenture trustees' fees and remuneration to works' committee, £5,915; first debenture interest, £22,500; second debenture interest, £10,000; preference dividend, £30,000; depreciation, £25,000; special depreciation, £30,000; reserve, £180,000; special reserve, £8,500; first mortgage debenture stock redemption, £5,000; 15 per cent. and 10 per cent. bonus for the year on the ordinary shares, £125,000; carrying forward £84,792. The works were exceptionally busy during the year. As already announced, it is the intention, subject to Treasury consent, to issue bonus shares by the capitalisation of £500,000 out of reserves, in the proportion of one new fully-paid ordinary share to the holder of each old ordinary share. Meeting: Liverpool, March 25th.

London United Tramways, Ltd.—According to the *Financial Times*, the committee appointed by the debenture holders has issued an interim report, in which it states that it has made considerable progress with the representatives of the shareholders in agreeing a scheme for the reorganisation of the whole capital. The arrangements are dependent upon the passing into law of a Bill now before Parliament, and until this is assured it is not possible to submit any definite proposals for the consideration of debenture holders. The proposed reorganisation provides for a great reduction of the present share capital, and the division of the existing debenture stock of £1,650,000 into equal moieties of 4 per cent. debenture stock and 5 per cent. preference shares non-cumulative for five years, but with priority of capital.

Automatic Telephone Manufacturing Co., Ltd.—Profit for 1917, after estimating excess profits duty and contingencies, £46,826, plus £14,774 brought forward. Directors' fees take £2,450, depreciation £10,000, written off underwriting commission on shares £4,000, preference dividend £12,000, ordinary share dividend 6 per cent. (less tax), £21,600, carrying forward £11,550. Work of national importance has kept the factory fully employed day and night at high pressure. No new telephone installations for public service have been undertaken during the year, but the installation at Leeds is now finished, waiting for the Post Office to put into service. It is understood that the public automatic telephone service will be available to the city at an early date. Several smaller exchanges have been undertaken during the year for Government departments, factories, and a colliery company, with satisfaction to the users.

The German Lahmeyer Co.—The directors of the Elektrizitats Gesellschaft vorm. W. Lahmeyer & Co., of Frankfort-on-Main, recommend an increase in the share capital from £1,500,000 to £2,000,000 by the issue of new shares of the nominal value of £500,000. The shares have been taken over by a syndicate at the price of 110 per cent., and will be offered to existing proprietors at 116 per cent. after the conclusion of peace. It is assumed that the additional capital is required for meeting the monetary needs of the company's subsidiary undertakings in the future. These are lighting and power works. The Zurich Bank for Electrical Undertakings, which still controls about two-thirds of the share capital in the Lahmeyer Co., is expected to take a share in the new emission.

Direct Spanish Telegraph Co., Ltd.—Including the amount brought forward, the accounts for 1917, after payment of income-tax and excess profits duty for 1916, show a balance of £45,598. After paying the 10 per cent. preference dividend, and a dividend of 5 per cent. and a bonus of 2 per cent (free of tax) on the ordinary shares, £5,000 is put to reserve, and £32,972 is carried forward, subject to special taxation. The Marseilles-Barcelona cable was interrupted during the year; the cost of repair, duly carried out, was £1,162. The other lines were in good working order throughout the year.

Hadfields, Ltd.—Further dividend on the ordinary shares of 4s. per share, together with a bonus of 1s. per share, making 6s. for the year, free of tax.

Slough & Datchet Electric Supply Co., Ltd.—During 1917 the lamps, &c., connected increased by 6,307 (30-watt) to 39,702, and the units sold by 311,624 to 1,679,183. The revenue was £14,327, against £12,012 for 1916. Increased production costs seriously reduced the profit, and no dividend can be recommended. Net profit £2,720, of which £2,000 is put to depreciation and reserve. After paying reduced fees to directors, £520 is carried forward.

Windermere & District Electricity Supply Co., Ltd.—Gross income for 1917 advanced by £55, but fuel oil increased by £4 per ton, so there was a very large advance in working expenses. Keswick Electric Light Co. has again been only able to pay 2 per cent. on account of arrears of debenture interest. Increased charges for current come into force there next month. £200 put to depreciation reserve; no dividend on preference shares; £85 carried forward.

Windsor Electrical Installation Co., Ltd.—The profit for 1917, including £519 brought forward, was £4,150. Debenture interest and preference dividend are paid, £1,500 is put to depreciation, renewal and reserve, and, after paying directors' fees and 2 per cent. (less tax) on the ordinary shares, £258 is to be carried forward.

Scarborough Electric Supply Co., Ltd.—New connections during 1917 were equivalent to 1,845 30-watt lamps, making 134,387. Units supplied 777,862. Profit £2,066. After paying bank interest and putting £1,000 to depreciation, the credit balance of £2,378 is to be carried forward.

Brompton & Kensington Electricity Supply Co., Ltd.—Final dividend at the rate of 12 per cent. per annum on the ordinary shares, making 10 per cent. for the year, less tax. Carried forward, £5,217.

British Aluminium Co., Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. per annum, making 10 per cent. for the year, less tax. To reserve £75,000. Carried forward £33,214.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during four weeks ended December 28th, 1917, 1,946,348, compared with 1,751,753 units in 1916.

Wood & Cairns, Ltd. (Electrical Factors, Edinburgh).—Dividend 10 per cent., less tax, on preference and ordinary shares. £700 to reserve, and £214 carried forward.

Madras Electric Tramways (1904), Ltd.—Final dividend on the 6 per cent. preference shares for the year to December 31st.

Robey & Co., Ltd.—Dividend, 7 per cent., less tax, on preference and ordinary shares, carrying forward £35,943.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter on the common stock.

STOCKS AND SHARES.

Tuesday Evening.

While the general course of business in the Stock Exchange continues quiet, there is a good deal of interest taken in particular markets, although the volume of business is small in consequence of the aftermath of the Tank campaign. It is thought in the Stock Exchange that another week will see the end of this factor, after which, no doubt, we shall have Budget anticipations put forward as a reason for business being slow. The various political developments abroad are sufficiently confusing to render the average investor cautious, nor is the spirit of speculation noticeably present.

Telegraph manufacturing shares are strong. The Callender's Co. has now published full particulars of the terms of the rearrangement of capital, and, thanks to this, the price of the shares has risen £1 to 18¼. Henley's, India-Rubber, British Insulated, Telegraph Constructions—in fact, any shares connected with this particular branch of industry are in eager demand, and, notwithstanding the fact that prices may not apparently respond, buyers are anxious to get the offer at any reasonable figure. India-Rubbers are 7s. 6d. up at 16. British Insulated are strong at 3¾: the company's report is a splendid one. Henley's hold their rise at 19½, on the distribution of new shares.

The General Electric Co. has taken over the Erith branch of Fraser & Chalmers, so that the reason of the rise in the price of the latter stands fully explained. General Electrics themselves are steady, the ordinary gaining ¼, and these, with the preference, still being wanted. Other shares in the group continue somewhat quiet. Electric Supply Corporation ordinary are firm at 25s., changing hands at this price a few days ago. Cromptons at 17s. for ordinary and preference alike are also steady. Edison Swan "A" shares are keeping just under 50s., and the first preference are quoted at 21s. 9d. Electric Construction Ordinary are 25s. 6d., business being done last week at 25s. 9d., and the 7 per cent. cumulative preference remains at a few pence over 20s. British Aluminiums became dullish on the dividend, making 10 per cent. for the year, whereas some had looked for 12½ per cent. Babcock drooped to 3¾, to rally to 3½ again.

The railway markets continue heavy, and pronounced dullness is noticeable amongst the Undergrounds. Metropolitans and Districts are both a poor market. Underground Electric Incomes have again receded a small fraction to 79½, and the £10 shares are also a little easier at 32s. 6d. Interest in the shilling shares has died away, and the price sticks closely to 5s. Nor is there much business doing in the steam stocks, the only feature being the determination with which the public refuse to look at them in spite of the good yields at present obtainable.

Marconis jumped up 5/16 to 3½ on the result of the company's action against the Government. The proceedings were followed with keen attention by a much wider circle than that of the proprietors in the Marconi Co. The remarkable nature of the evidence aroused surprise on the one hand, followed by very optimistic anticipations of what the company may be expected to receive by way of compensation. The subsidiaries are unaffected, Americans being 24s. 9d., Canadians half-a-guinea, Spanish and General Wireless Trust 8s. 6d., and Marconi Marines—once more the subject of a Stock Exchange tip to buy—50s. to 51s.

Electricity Supply shares are mostly firm, but the proposals to close theatres (and possibly restaurants) at 9.30 p.m. have aroused some wonder as to how this is likely to affect lighting companies. With "Summer-time" starting sooner this year, and the prospect of London turning over a new leaf in the way of going to bed earlier, the situation holds elements of uncertainty for all concerns dealing with illumination; gas stocks have come down rather sharply of late. At last Monday's meeting of the County of London Co., the chairman announced that inter-connection between this undertaking and the South London Electric Supply Co.'s station had now been established, while they, furthermore, had become interconnected with the Sutton station of the South Metropolitan Electric Light and Tramway.

London United Tramways debenture has subsided to 42 after touching 44½. Castner-Kellners strengthened to 3¾. Colonial and foreign issues are quiet but firm, with greater inquiry for certain of the Canadian manufacturing issues. Rubber shares have enjoyed a smart rally, on the price of the produce mounting above 2s. 6d. per lb. A large business has sprung up in the principal shares. Lively speculation in tin mines has followed the recent rise in the price of the metal. Armaments are steady, without attracting much attention.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price March 19, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	69	+ ½	£7 8 2
Charing Cross Ordinary ..	5	5	83	— ½	6 18 0
do. do. do. 4½ Pref..	4½	4½	81	—	6 18 6
Chelsea	3	3	3	—	5 4 4
City of London	8	8	125	—	6 4 3
do. do. 6 per cent. Pref.	6	6	105	—	5 18 6
County of London	7	7	115	—	6 6 0
do. 6 per cent. Pref.	6	6	105	—	5 18 5
Kensington Ordinary	6	7	85	+ ½	6 7 3
London Electric	Nil	Nil	1¾	—	Nil
do. do. 6 per cent. Pref.	4	5	34	—	8 0 0
Metropolitan	3	4	3¾xd	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	81	—	6 13 4
St. James' and Pall Mall ..	8	9	7½	—	6 6 4
South London	5	5	2⅞xd	—	7 2 4
South Metropolitan Pref. ..	7	7	84	—	6 18 4
Westminster Ordinary	7	9	6⅞	— ½	6 15 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	22/6	1½	12⅜	—	6 13 4
Chile Telephone	8	8	7½	—	5 10 4
Cuba Sub. Ord.	5	7	9⅝	—	*7 11 4
Eastern Extension	8	8	15½	—	*5 6 0
Eastern Tel. Ord.	8	8	159½	— +1	*5 4 7
Globe Tel. and T. Ord.	7	7	14½xd	—	*4 18 8
do. Pref.	6	6	10	— ½	6 0 0
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	61½	—	6 6 8
Marconi	10	15	3½	+ 5/16	4 5 9
Oriental Telephone Ord. ..	10	10	4½	+ 1/16	2 7 1
United R. Plate Tel.	8	8	6⅛	—	*5 17 4
West India and Pan.	6d.	6d.	1⅛	—	*3 17 0
Western Telegraph	7	8	15½	—	*5 2 5

Home Rails.

Central London, Ord. Assented	4	4	61½	—1	6 10 7
Metropolitan	1	1	30½	— ½	4 15 3
do. District	Nil	Nil	14¼	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	19½	— ½	*5 0 8

Foreign Trams, &c.

	Dividend 1916.	Dividend 1917.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	6½	6½	2⅞	—	—
do. 2nd Pref. ..	6½	—	2⅜	—	—
do. 5 Deb. ..	5	5	66½	—	7 10 6
Brazil Tractions	4	4	44½	—	—
Bombay Electric Pref.	6	6	9¼	—	6 6 4
British Columbia Elec. Ry. Pfce.	5	5	52	—1	9 12 4
do. do. Preferred	Nil	Nil	34½	—	Nil
do. do. Deferred	Nil	Nil	23	—	Nil
do. do. Deb.	4½	4½	58xd	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Ni
do. 6 per cent. Bonds	Nil	Nil	84½	—	Nil
Mexican Light Common ..	Nil	Nil	17⅝	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	98	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3¾	—	4 5 9
British Aluminium Ord. ..	7	10	11¾	—	6 0 9
British Insulated Ord.	17½	20	3¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2⅛	—	5 2 0
Callenders	20	20	19½	+1	5 9 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	10	5⅜	+ 1/16	5 10 4
Edison Swan, fully paid ..	—	—	2⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1½	—	6 0 0
Gen. Elec. Pref.	5	5	16⅜	—	6 15 8
do. Ord.	10	10	19½	+ ¼	5 1 9
Henley	25	25	19⅜	—	6 9 2
do. 4½ Pref.	4½	4½	8½	—	5 12 8
India-Rubber	10	12	16	+ 0	*6 5 0
Telegraph Con.	20	25	41½xd.	—	*5 15 7

* Dividend paid free of income-tax.

THE CONTROL OF LARGE AMOUNTS OF POWER.

By E. B. WEDMORE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Continued from page 246.*)

The arrangement of spare plant will be found to be a question which vitally affects the design and use of reactances. If we plan for five machines clearly we cannot employ six bus-bar sections, or a symmetrical arrangement of three, and if we use four the fifth machine cannot conveniently be connected up as a spare to any one section.

The number and size of machines should preferably be determined so that with adequate provision for spares the machine capacity will be divided equally between the sections, the number of sections being such as to give the required degree of protection whilst suiting the local conditions.

We desire to transfer power from section to section for purposes of economy, and this transfer may amount to 20 to 70 per cent. of the capacity of a section. This transfer may take place in either direction. For it to take place at all it is necessary to set up a difference of potential between sections, whereas working conditions require that the sections shall be at substantially the same voltage.

The transfer of the energy component of current through the reactance will not require a potential difference greater than is necessary to overcome the ohmic resistance, and this will be some small fraction of 1 per cent., perhaps one-fifth with 10 per cent. reactance between sections. To transfer magnetising current, however, will require a relatively large potential difference, and this will be in fact the reactance drop at the current in question, and this proves to be the limiting feature.

For example, with 10 per cent. reactance between sections, the difference will be 1 per cent. if the magnetising current transferred is numerically one-tenth of the rated current capacity of a section. That is to say, to transfer this amount of magnetising current would require that the bus-bars should be run respectively ½ per cent. above and below normal.

If the load is transferred at 80 per cent. power factor the magnetising component will be 60 per cent. of the K.V.A. transferred. If, therefore, this magnetising component is limited to one-tenth of the section capacity, the load transferred would be limited to 10/6ths of this figure, *i.e.*, one-sixth of the section capacity, whereas we want to transfer perhaps four times this load.

The obvious solution appears to be to transfer the load at a higher power factor and to make up the shortage of magnetising current by supplying it from the machine or machines tied to the section in question.

In pushing the use of reactances up to the limit it is necessary to utilise this method of maintaining the voltage, but it is not one which should be used under daily working conditions. It involves underloading one or more of the machines, extra care in running adjustments, and in case a fault occurs on the section receiving current, the voltage drop will be greater.

The practical possibilities of this method of control are that ample protection can be obtained by the use of generator and bus-bar reactances under normal working conditions without resorting to transference at a power factor above that of the load; but this method can be advantageously resorted to under emergency conditions.

There is a preponderance of advantage in the use of two unit machines per section, or, of course, the equivalent in smaller machines. If larger units are installed later than were originally contemplated, these may be of twice the size, and arranged one per section with suitable reactances, and without materially affecting the short-circuit factor.

As a typical example of what can be done, we may take the case of five sections and two machines per section. Here with generator reactance of 15 per cent., and bus-bar reactance of 7½ per cent., we get a short-circuit factor of 3.3 on the maximum output. That is, a station rated to give 100,000-K.V.A. output would give 333,000 K.V.A. on a fault between phases near the source.

Where relatively small and remote sources of power are coupled to a large system they improve the supply in their immediate neighbourhood. It will generally be found that the inherent reactance in the feeders and transformers is sufficient to prevent excessive increase of short-circuit currents in the neighbourhood.

The question arises, how will the employment of reactances between sections affect parallel running. This becomes particularly important in the case of stations remote from one another tied together for economy. Such ties may not be of large cross-section, and may therefore introduce considerable resistance.

It has been found that it is not generally practicable to obtain stable running conditions where the ohmic value of the total reactance in circuit between the machines is less than about twice the resistance. This necessitates the employment of external reactance in series with long underground tie cables of small cross-section. Where, however, there are step-up and step-down transformers in the circuit there will be ample reactance.

One must not expect to find any protection from internal resistance of faults, except when the fault is to earth through a poor earth connection, or includes a long open arc.

Where porcelain insulators are mounted in brick or stone the supporting wall reinforces the insulation, and, even if a cracked insulator discharges, the current at 6,000 volts will be quickly reduced from perhaps 5 amperes to a negligible figure as the wall dries by the heat generated.

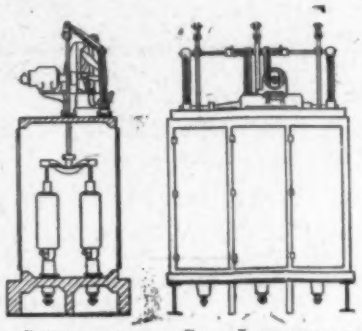

Fig. 7.—Oil Switch showing Good Insulation to Earth and Between Phases.

In the case of carbonisable material, however, as in cables and machine windings, the energy liberated at the fault will cause the conductivity to develop in a small fraction of a second to a figure offering no further limiting effect.

On a system working at, say, 6,000 volts to earth, a fault to earth of only 1 ampere releases 6 K.W. to heat up the insulating material locally, and when the resistance has fallen to 5 ohms there will be a local application of more than 7,000 K.W., so it is clear that the development must be extremely rapid in the later stages. On insulated systems operating at 6,000 to 10,000 volts, and even where the current to earth is limited to a capacity current of, say, 10 to 20 amperes, the first indication of a fault to earth is always the occurrence of a dead short-circuit to earth.

What happens is that the insulating material is carbonised locally so completely that the fault resistance is reduced to a point such that the energy liberated almost ceases to cause further destructive heating.

As faults to earth can be positively limited by the employment of resistance in the earth connection, it is only faults between phases that present a serious problem. The likelihood of such faults occurring can be greatly minimised by appropriate design.

When conductors are air-insulated they may be separated by substantial insulating barriers and kept clear of earthed metalwork. The barriers should be sufficiently large and substantial to confine the disturbance arising on failure of the apparatus they separate.

A good example is to be found in a large oil switch constructed as in fig. 7 with insulated tanks, those on each pole being enclosed in a stone or brick cell.

Conductors surrounded with insulating material may be further separated by earthed metal barriers so arranged that a fault to earth is confined to the phase on which it occurs.

A good example is found in a machine in which the conductors throughout their length, including the end turns, are covered with insulating material and separated by earthed metal parts with which they are in intimate contact. A breakdown on such a machine must arise as a fault to earth, and is localised by the formation of a good enclosed conducting path to earth. The risk of open arcing is minimised, and consequently the risk of the fault spreading to other phases and consuming the whole machine.

The advantages obtained by the use of selective protective apparatus on large distributing systems are now generally recognised. They play an important part in economical distribution, and an essential part not only in localising disturbances, but in limiting their duration. This latter function is useful in preventing the development of disturbance due to unstable conditions, as, for example, in parallel running, but is especially important on large plants where the factor of safety against overheating on short-circuits is likely to be small.

The use of such apparatus throws a severe duty on the switchgear, as switches have to clear faults whilst the currents are in the neighbourhood of maximum value (see fig. 1), and the onus of clearing each particular fault is thrown on the individual switch or switches nearest to it.

For these reasons it is necessary to employ with the selective protective apparatus a system of stand-by protective apparatus which comes into use in case of failure of switchgear or selective apparatus. This takes the form of a system of fixed time-limit relays with graded settings which will come into operation only after failure in the first line of defence. A plant so protected will be as well off even on failure of the selective apparatus or distribution switchgear as plants have been in the past which were protected solely by the apparatus now used as a stand-by.

It is clear, therefore, that the provision of an adequate stand-by system justifies working with a lower factor of safety on the smaller circuits, especially if the conditions are favourable and the plant well designed in the first place to minimise the occurrence of severe faults. Existing switchgear may be retained on extension of plant by relying on the stand-by protection to save the plant, if the margin is not too small.

For example, switchgear rated at 20,000 K.V.A. might be employed to clear faults of 30,000 to 40,000 K.V.A. with stand-by protection, as, if the conditions are favourable to the switch, even the larger faults may be cleared satisfactorily, and the severest disturbances should be few and far between.

The author acknowledges his indebtedness to Messrs. The British Thomson-Houston Co., Ltd., for facilitating the preparation of the paper, and to Mr. A. R. Everest and other colleagues for valuable assistance.

(To be concluded.)

ELECTRIC POWER SUPPLY AND COAL CONSERVATION.

A DEBATE on the Interim Report of the Coal Conservation Sub-Committee on Electric Power Supply of Great Britain took place at the Engineers' Club, Manchester, on March 5th. Mr. GEORGE HUGHES presided.

Mr. S. L. PEARCE, chief electrical engineer of the Manchester Corporation, was the principal speaker. He said that few reports had ever been issued which had created such widespread interest as the one under consideration. It was believed to be the work of one very eminent engineer, Mr. C. H. Merz. He viewed the report as an endeavour to formulate a national scheme for the future of electrical supplies to industry, and with the major portions of the Committee's recommendations he was more or less in agreement, in so far as they contained suggestions bearing on engineering and technical questions. As regarded the success of large undertakings, it seemed to him that the Sub-Committee's case rested to a very great extent on assertion. They were given no figure at all as to the anticipated cost of these super-power stations, the estimated cost of energy, and more particularly the cost of transmission. The case was based upon an estimated present consumption of 5 lb. of coal per H.P.-hour in industrial plants.

When dealing with the question of municipal control *versus* company control, the Sub-Committee was forgetful of the pioneer work that had been done by so many municipalities; it had attempted to belittle their work, and had developed with special pleading, and by means of unfair comparison and erroneous data, a special bias against local authorities.

The main proposals came under five heads:—(1) The setting-up of a central body of electricity commissioners; (2) the delimitation of the country into districts; (3) the appointment of boards to control the whole of the generation and transmission in these districts, leaving the detailed distribution of electricity and sale of electrical energy more or less in the hands of existing authorities; (4) the installation of large power plants in order to obtain the maximum economy in capital outlay, efficiency in operation, and diversity of demand; (5) the laying-down of a system of extra-high-tension mains which should interconnect station with station.

The first recommendation in effect was that the present system of over 600 districts, each having its own undertaking, should be superseded by a comprehensive system under which the country was divided into some 16 areas. That number was likely to be very substantially increased. For the purposes of economical production and transmission of electricity, the municipal boundary as they knew it must be broken down. Economic considerations alone should determine the electrical areas, and not local government.

The second and third recommendations both bore on the same subject, viz., the selection of sites for the new super-power stations. The Committee suggested that sites should be chosen on important waterways, and he quite agreed. The North-East Coast possessed plenty of good sites on important waterways in close proximity to collieries, but this was not the case all over the country. He knew of no inland sites in Lancashire which possessed ample water facilities for stations of, say, 100,000 KW., requiring a minimum flow of 8 to 10 million gallons per hour, or its equivalent. The alternative to these waterways was cooling towers. The strictures that had been passed by the Committee in Clause 17 on certain municipalities were based on two grounds, and the chief was that these had adopted, partially or exclusively, cooling towers for condensing purposes. A second reason was that municipalities had endeavoured to retain generating stations within city areas for the sake of the rates. So far as Manchester was concerned, they were wrong in their facts. He entirely dissented from this wholesale condemnation of cooling towers, as he held that the transmission cost from a water-side site might more than counter-balance the extra working cost due to cooling towers. The whole of this report was too much coloured by North-East Coast experience, and North-East Coast facilities. He had made very elaborate calculations, and gave them in detail in his evidence before Sir Archibald Williamson's committee. He considered the question of a Mersey-side site for Manchester at which it would be possible to obtain ample river water for condensing purposes. The load to be transmitted from the station was 100,000 KW., .8 power factor, 66 per cent. load factor, transmission voltage 150,000 volts, which was the highest voltage that had so far been used in the States. The annual charges on such a transmission line would be of the order of £100,000 to £125,000 per annum. Supposing they were to establish a station in Manchester and use cooling towers, it would result in an increased coal bill, because it was impossible with cooling towers to obtain a vacuum of more than 27 in. or 27½ in. at the outside, as against the figure of 29 in. or 29½ in. with a natural waterway and plenty of cold water. Therefore, he had assumed an increased coal consumption of 15 per cent. Then there were all the costs incidental to the towers. Summing up, he estimated that the extra annual costs for cooling towers compared with a natural waterway were of the order of £70,000 per annum. Clearly, it would not pay Manchester to go to the Mersey-side for current.

With regard to coal transport costs, taking the same data, he had come to the conclusion that it would only pay to establish power stations 30 miles away from the area of supply if they could get coal 5s. per ton cheaper, facilities being the same in their own area and 30 miles away. It would not pay Manchester to have a power station at a distance exceeding 20 miles from the area of supply for the purpose of obviating the use of cooling towers, assuming there was no advantage to be gained in the cost of coal. The above figure of 20 miles could be increased to the extent shown in the previous calculation if cheaper coal and ample water were both available. Such sites did not exist in Lancashire.

The third point was that it was difficult to establish a case in favour of transmitting electrical energy rather than railing coal. The superiority of electrical transmission only became apparent with very high load factors.

His chief ground for criticism of these two recommendations of the Committee was that it appeared to lay too much stress on the suitability of a site to enable it to obtain a low cost at the station bus-bars; it had rather stressed that point because of the importance it attached to the establishment of electrochemical works alongside of the station, and had shut out to too great an extent the question of the cost of transmission. Insufficient stress was laid on the desirability of having a station site well situated with regard to the load which it had to supply. As regarded the third recommendation, he was quite at one with the Committee in insisting upon sites being chosen as large as possible in view of the possible adoption at a later date of gas distillation processes.

In the fourth recommendation the Committee advocated the preparation of plans for the construction immediately after the war of these large super-power plants. Who was the competent authority to select the sites? He hoped that the Commissioners or whatever Government tribunal might be appointed would be set up as soon as possible, so that there might be some co-ordination given to this national policy, and the final approval of the sites that might be selected should rest with the Commissioners. At present it seemed that there was a great tendency on the part of various authorities, both company and municipal, to start pegging out claims in advance. The fourth recommendation contained this sweeping statement:—"Existing generating plants are uneconomical, and ought to be scrapped." This recommendation would appear to constitute a wholesale condemnation of existing stations, some of which were fairly modern, and some of which could be usefully and economically extended. This suggestion of wholesale scrapping did not seem quite to square with the somewhat freely advertised merits of a North-East Coast supplier, and its ability to displace all and sundry private plants. Whilst it was obvious that very many plants were out of date, he dissented from the policy of wholesale scrapping.

So far as Lancashire was concerned, some existing stations could be usefully extended with large plants, and these extensions, together with the erection of the super-power stations, might very well go forward together. If such a scheme were adopted, coupled with the linking-up of the stations, that would be the line of true progress.

He fully agreed with the recommendation contained in this report that any interconnecting scheme to be effective must be coupled with unity of control. There was not much hope of a final solution to this question by voluntary effort alone. In Lancashire there was a million or a million and a quarter of coal-consuming horse-power in the 35 undertakings referred to in the Lancashire and Cheshire reports. The maximum demand on these last year was 175,000 KW., equivalent to about 600,000 H.P. installed on consumers' premises, so that the margin between the 600,000 and the 1¼ millions would afford plenty of scope for power extensions.

In the fifth recommendation, viz., that by-product plant should be combined with power plant, the Sub-Committee showed a very commendable degree of caution, which was somewhat lacking in other parts of the report. The question whether electricity or electric power could be obtained more cheaply if the coal used for steam raising was first subjected to processes of carbonisation and gasification had not yet been satisfactorily answered.

The question might have to be put and answered sooner or later: Was the electric consumer to pay more for his

electric power supply in order to benefit the nation by conserving the coal supply?

With the sixth recommendation of the Committee there would be practical unanimity. Waste-heat stations had proved to be very advantageous on the North-East Coast, and in the majority of cases, he believed, they had incidentally involved the use of cooling towers.

He came to what was a very contentious point in the seventh recommendation in the Committee's report—the question of stopping extensions to all existing stations. That, he thought, was too general a statement. It was an assertion without data or proof put forward on the ground, presumably, that the new super-power station must necessarily be able to deliver energy into existing areas at a lower rate per unit than modern extensions to existing stations could possibly do. The famous Table V of this report had been very severely criticised, and should never have been found within its pages. It purported to be a comparison between the prices of energy on the North-East Coast and in Lancashire. The comparison was very misleading, and grossly unfair. Before he came to the figures, it was necessary to say a word with regard to the power companies on the North-East Coast. A pamphlet had come into his hands from the pen of a former secretary of one of the North-East Coast power companies, and a shareholder in one of the companies, Mr. Andrew Gemmell; if his remarks were not true they ought to be contradicted by the companies at the earliest possible date. He said:—

"The average selling price of ½d. per unit for company enterprise in the North of England in that report is of little value without stating the companies to which it relates, because one company or group of the existing combination can be made to have the appearance of success with disastrous results to another section of the combination; and it has been the practice of the North of England companies not to give all the statutory statistics, which would have shown annually the average selling price."

The North-East Coast output was mainly a bulk supply; lighting was a very small portion of their business. In Lancashire that was not the case. The municipalities dealt with a mixed business. The bigger proportion was power, but there was a big lighting load, and a big tramway load.

To the North-East Coast prices they must add figures that would cover the cost of transforming and distributing the high-tension energy which was delivered in bulk. Let them take the case of Tynemouth. The bulk-supply price to Tynemouth from the Newcastle Co. was not .5d.; it was .64d. These were high-tension units. After transforming and adding distribution charges, the Tynemouth prices were as follows:—

For private lighting	...	...	1.05d. per unit.
For public lighting	...	...	1.7d. per unit.
For tramway supply	...	...	1.27d. per unit.

If they would compare these prices with Lancashire, they would see they were very similar, although Tynemouth had the advantage of purchasing its bulk supply from the Newcastle Co. at what was supposed to be an extraordinarily low rate. By way of further argument, Mr. Pearce called attention to a table which he had put in evidence before the Board of Trade, dealing with an average selection of large and medium-sized towns of Lancashire and Cheshire. He dealt first of all with the average price per unit sold for industrial power purposes. It was the power delivered at the consumer's terminals at low-tension in nearly every case. The prices varied from .47d. to .68d. The percentage of industrial power units sold in these undertakings varied from 53 per cent. to 90 per cent., the Manchester figures being 75 per cent.

A very vital point was the question of finance. This comparison pre-supposed that the methods of finance of the company and municipality were exactly the same. Did the companies on the North-East Coast set aside out of profits the same amount for reserve and depreciation? They were very different indeed. Taking the case of Manchester, and comparing it with the North-East Coast, in each case the capital outlay was about 3¼ millions sterling, but whilst, for depreciation purposes, they put aside £30,000, equal to about 1.14 per cent. on the capital outlay, Manchester put aside £160,000, which was equal to 5 per cent. This deficiency alone made a difference on the Manchester output of .19d. per unit sold. It was absurd to talk of Table V. being a true comparison. He made the broad statement that, generally speaking, local authorities both produced and sold more cheaply than companies.

One of the last recommendations, viz., the advocacy of setting up electric commissions with certain definite powers, was the one point upon which there seemed to be more or less agreement. It would be an exceedingly good thing if the electricity supply industry did have a tribunal to itself. Therefore, he expressed a strong measure of agreement with the setting-up of these Commissioners with the powers that it was proposed to give them, with this proviso, that, as regarded deciding the type of district authority and the setting-up of that district authority, after the commissioners or the central authority had made up their minds as to what was the best thing to be done for this or that district, their policy or plan should receive the approval of Parliament.

With regard to the constitution of the Commissioners, the majority should be engineers with an extensive experience of the control and management of electrical undertakings. Many of the Local Government Board inspectors were not trained electrical engineers, therefore the problems they might have to consider and deal with at the inquiries were perhaps not always considered with the advantage of sound electrical engineering knowledge.

He would go a step further even than the Merz report with regard to the district boards or authorities, and would accord to them certain powers of rectifying boundaries of existing areas, for distribution purposes, and generally vest in them the final approval of the area as laid down for local distribution purposes.

Coming to the last section of the Merz report, dealing with alternative types of new electric power organisations, or district authorities, he saw no solution along the line of combined ownership and operation by local authorities and companies. Any such scheme would sooner or later break down on the question of finance. The fourth alternative should be very carefully considered, namely, a body of trustees incorporated by Parliament to form a trust on the lines of the Mersey Dock and Harbour Board, in which the traders' interests would predominate, but which did not rule out the possibility of the local authority having representation. In such a trust there were no shareholders and no dividend. Money was raised on the business that was done, *e.g.*, in the case of the Mersey Docks and Harbour Board on the trade of the port. Where a municipal board was set up, provision should be made to limit profits being handed over for the relief of rates. Where a company board was set up, there should be an effective limitation of dividends provided by statute. He would rule out State ownership and control absolutely. It was essential that they should have the same type of board for every district. Regard should be had, as far as possible, to the paramount interest, and therefore, seeing that in Lancashire municipalities predominated so much—only 10 per cent. of the electrical output for the whole of Lancashire was sent out by companies, and the remaining 90 per cent. by municipalities—Lancashire should be municipal, whilst the North-East Coast should be company. The principle of public ownership should be adopted as the basis on which to build up a new and truly national system over the whole of the country, whatever might be done in certain parts as regards operations. In this connection he would again refer to Mr. Gemmell's pamphlet. It was one of the most scathing documents on company enterprise, and if it was wrong, no time should be lost in refuting it absolutely; if it was right, then, in his judgment, it would have dealt a heavy blow to private company enterprise.

The report closed with the pious hope that State assistance might be invoked in connection with the establishment of a national system, but it did not give any clue as to the manner in which it considered that financial assistance should be given. Was the State going to advance capital to equip these super power stations? He held that much more effective assistance could be given (if the State had any money to give away) if it were applied to writing off a debt on obsolete plants, which undoubtedly existed in many stations; in any case, there was a very big outlay to be faced. That of itself would militate against any very early drop in the price of electricity.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

The annual general meeting of the B.E.A.M.A. was held at the offices of the Association on February 28th, when the report and accounts for the financial year ending September 30th, 1917, were adopted. We mentioned in our last issue the names of the five firms elected to fill the vacancies on the Council.

The Chairman referred to the previous report recording the appearance of the B.E.A.M.A. representatives as witnesses before the Committee appointed by the Board of Trade "to consider the question of the Electrical Trades after the War." The report of that Committee had been long delayed and had not yet been published; but he did not think he would be committing any breach of confidence in stating that he believed the report was a very strong one, and that it would be received with gratification by the industry, particularly as it was understood to speak largely along the lines of the B.E.A.M.A. evidence. Turning to the work of the Association during the past session, the Chairman said that two important reports in which the industry was interested had made their appearance. The first was that of Lord Buckmaster's Committee on Pre-War Contracts (Cd. 8975) which, he regretted to say, appeared to afford little direct practical help to contractors, but, in traversing old ground, offered some new suggestions of which, failing Government action, they might be able to avail themselves. The second was the Coal Conservation Sub-Committee's Report (Cd. 8880). This deserved their very careful attention, and would, he hoped, shortly be the subject of action by the Association. As to B.E.A.M.A. conditions of contract, it was satisfactory to re-

cord that less difficulty in settling contracts was experienced and their conditions were making steady headway. The subjects of research and education were in their front line of action, and he looked for rapid progress as soon as the Research Department had settled into its stride and the Education Bill had been advanced. Standardisation had made satisfactory progress during the year. As to other matters, they were in close touch with the work of the Federation of British Industries and the British Empire Producers' Organisation, and it went without saying that they were working jointly in many matters with their old friends the E.S.C., the I.E.E., and the C.M.A. The Articles of Association had been entirely recast and the B.E.A.M.A. was now an Association for manufacturers exclusively, the classes of "Associate Member" and "Associate," consisting chiefly of factors, having been cut out. The Chairman concluded his remarks with some words of high approbation of the work of the permanent staff of the Association and with the announcement that the Council had conferred upon the secretary the additional title of "Director."

The report, which was adopted unanimously, stated that the number of members on the register at December 31st was 178; 33 firms were admitted to membership during the year, and one resigned. Members had been fully engaged in the production of war material. They had given their best efforts, and they hoped that the experience gained under the pressure of war requirements would assist towards the development of increased production at the conclusion of hostilities.

While the export trade continues to be necessarily restricted, it has been possible to maintain certain overseas connections, and in some instances to supply the demands hitherto met from enemy sources. This has been rendered practicable on the one hand by means of rations of metals granted to the Association under special priority permits for the manufacture of apparatus for export, and, on the other hand, by licences granted to the Association for the import of materials equally essential to manufacture.

The Overseas Committees have been engaged in consolidating previous work, and standard conditions of contract are being more extensively used by Government Departments and Municipalities, especially in Australia and South Africa, as a result of their activities. The Australia Committee has been of assistance in connection with income-tax and import duties and has made valuable reports on the question of America and Japanese competition. Similar reports have come from the South Africa and India Committees, and it is hoped that, acting on the advice of the Main Export Committee, the Overseas Committees will be able to secure that some form of control over the importation of foreign accessories shall be enforced similar to that exercised by the Licensing Committee in this country. As a result of action taken by the Australia Overseas Committee, the conditions of certain contracts for the Victorian Railways have been modified to give British at least an equality of opportunity with American, Japanese, or other foreign manufacturer.

The question of the piracy of trade marks has also been taken up with the Dominion Governments.

The South Africa Committee is co-operating with the local Standardisation Committees of the E.S.C., and also with the Association of Municipal Electrical Engineers (Union of South Africa), in standardising rules and regulations for electrical supply. This Committee has also supported the action of the local Chamber of Commerce in proposing to the Government that in any new leases granted in connection with East Rand Gold Mines, clauses shall be inserted providing that the lessees shall not place any handicap on British manufacturers. A member of this Committee is chairman of the Electrical Section of the Johannesburg Chamber of Commerce, thus ensuring co-operation between the two bodies in matters affecting the welfare of the British electrical industry in South Africa.

In India, owing to the action of the local Overseas Committee, there is a growing tendency to favour British electrical manufactures.

Useful reports have been received from the Argentine Overseas Committee, and, largely owing to their initiative, a strong Electrical Sub-Section of the Chamber of Commerce has been formed, one of the members of the Overseas Committee being the first chairman. The Committee is also working in close co-operation with H.M. Commercial Attaché, who has attended several of its meetings.

Owing to the disturbed condition of Russia, the activities of the Overseas Committee in that country are naturally restricted.

Several of the Association's recommendations to the Board of Trade Electrical Trades Committee in 1916 have been embodied in the recently-created Department of Commerce and Industry, in particular in regard to a larger number of Trade Commissioners and Commercial Attachés being appointed and their status being raised. The three Trade Commissioners since appointed to represent this country in Australia, India, and South Africa were invited, before taking up their new duties, to meet the Export Sub-Committee charged with the duty of considering overseas organisation. As a result of this conference it is anticipated that a closer degree of co-operation than hitherto will be maintained in the future between the Trade Commissioners and the Overseas Committee of the Association.

The position of Trade Commissioners in Overseas Dominions cannot yet, however, be regarded as entirely satisfactory. Reports have been received from the Australian Overseas Committee contrasting very unfavourably the position of British Trade Commissioners with that of American Commercial Attachés.

The report refers to work done in the interests of British manufacturers in regard to Dominions income-tax and Dominions import duties.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

3,772. "Regulating devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 4th.

3,788. "Diaphragm for sound-recording and reproducing machines, telephones, &c." H. A. McInnes. March 4th.

3,793. "Magneto-electric pocket lamp." E. Jaquemot & M. A. Pattay. March 4th. (Switzerland, May 29th, 1917.)

3,803. "Telephone transmitters." J. Eck & Photector Co. March 5th.

3,804. "Telephone mouthpieces." J. Eck & Photector Co. March 5th.

3,824. "Dynamo-electric machinery." E. Greenhalgh, B. Longbottom and Lo-Thermo Patents, Ltd. March 5th.

3,829/3,830. "Conversion of basic or heat energy contained in energy-carrying fluids into electrical energy." F. Hamer. March 5th.

3,837. "Mine signalling apparatus." C. King & W. Smith. March 5th.

3,840. "Electric cells and batteries." R. S. Baxter. March 5th.

3,842. "Apparatus for electrical separation of suspended particles from gaseous bodies." H. C. Bingham and Huntingdon, Heberlein & Co. March 5th.

3,846. "Electric switching devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 5th.

3,848. "Electric switches." British Westinghouse Electric & Manufacturing Co. & F. B. Holt. March 5th.

3,854. "Electric switch for control of internal-combustion engines." W. D. Meagher & T. H. Ratcliffe. March 5th.

3,856. "Electric batteries." G. N. Antonoff. March 5th.

3,869. "Magnetos." Compagnie Generale Magnetos. March 5th. (France, May 4th, 1917.)

3,870. "Magnetos." Compagnie Generale Magnetos. March 5th. (France, May 3rd, 1917.)

3,878. "Adjustable electric resistances." R. K. Hearn. March 6th.

3,883. "Mechanism for regulating electrodes of electric furnaces." V. F. Turner & J. Walker. March 6th.

3,890. "Terminals for electric dry cells, &c." W. A. S. Hellyar. March 6th.

3,913. "Arc lamps." G. Gautier, A. Garbarini & L. Mauclaire. March 6th. (France, October 13th, 1917.)

3,918. "Electric transforming and converting apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 6th.

3,920. "Electric accumulators." G. P. Pearson. March 6th.

3,925. "Number dials for automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., J. E. Collyer, G. W. Moore, Siemens Bros. & Co., and Western Electric Co. March 5th.

3,951. "Electromagnetic lock-out switches for motor control systems." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 6th.

3,952. "X-ray tube stands." E. C. R. Marks (Reid). March 6th.

3,963. "Telephone receiver earpieces." A. C. Brown. March 6th.

4,000. "Internal-combustion engines having electric ignition." R. W. Maudslay & Standard Motor Co. March 7th.

4,017. "Mechanism for varying point of ignition in magneto-electric ignition apparatus." Akt. Ges Brown, Boveri et Cie. March 7th. (Germany, March 23rd, 1917.)

4,025. "Electric heating elements and resistances." C. O. Bastian. March 7th.

4,026. "Electrically-heated clothing, &c." C. O. Bastian. March 7th.

4,030. "Armatures." Compagnie Generale de Magnetos. March 7th. (France, May 5th, 1917.)

4,040. "Ignition circuits of magnetos." Compagnie Generale Magnetos. March 7th. (France, September 29th, 1917.)

4,044. "Circuit-breakers for ignition magnetos." Soc. Labrosse et Esteve. March 7th. (France, September 6th, 1917.)

4,045. "Electric light bracket fittings." M. J. Railing & T. Taylor. March 7th.

4,057. "Wireless telegraphy and telephony variable tuning condensers." E. E. G. Boite. March 8th.

4,058. "Electric current collectors." A. Barham. March 8th.

4,059. "Signals for mines, &c." H. Drabble. March 8th.

4,060. "Electrical means for detecting presence of metal masses." E. W. Marchant. March 8th.

4,064/4,065. "Dynamo-electric machines." Lancashire Dynamo & Motor Co. & H. B. Whitmore. March 8th.

4,073. "Sparking plugs." J. Puerto & C. R. de Tassigny. March 8th. (Spain, March 17th, 1917.)

4,074. "Double plug ignition means for internal-combustion engines." R. W. Stanfield. March 8th.

4,085. "Electrolytic cell." F. A. Brown & J. Morton. March 8th.

4,086. "Combined electric air-speed and turning indicator." H. C. Weston. March 8th.

4,090. "Safety devices for elevators, &c." Waygood-Otis Co. (Otis Elevator Co., U.S.A.) March 8th.

4,091. "Brake-controlling devices for electromagnetic brakes, &c." Waygood-Otis, Ltd. (Otis Elevator Co., U.S.A.) March 8th.

4,120. "Heating conductors of thermic-telephones." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 8th.

4,125. "Trip-cancelling switch." Sterling Telephone & Electric Co., Ltd., F. G. Bell & W. C. Davey. March 8th.

4,131. "Electro-mechanical power transmission systems." Leyland Motors, Ltd., & J. G. P. Thomas. March 8th.

4,147. "Means for making and breaking electric circuits." W. A. Brame. March 9th.

4,153. "Arc-controlled mechanism for electric arc furnaces." W. J. Poole. March 9th.

4,163. "Device applicable to magnetic compasses and for use in compass readings." W. H. Woods. March 9th.

4,189. "Electric plug receptacles." W. Ilk & H. Fairbrother. March 9th.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,536. Electric Annunciator Systems for Calling Attendants. E. E. Rogers. December 6th, 1916. (113,291.)

1917.

196. Shock-resisting Winding for Rotating Magnet Coils. Vulkan Maschinenfabriks Akt. Ges. May 24th, 1916. (Addition to 3,919/12.) (106,992.)

538. Apparatus for Electric Welding. J. Crichton. January 11th, 1917. (113,293.)

607. Lamps or Lanterns for Light Projectors, such as Searchlights, Headlights, or the like Apparatus. H. Scholey (Soc. Anon. des Phares et Lanternes Tub.). January 10th, 1917. (113,296.)

2,163. Electromagnetic Brake. H. V. James. February 12th, 1917. (113,308.)